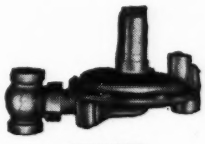
No. 00 DOMESTIC METER

FLOW INDICATING METERS



SERVICE REGULATOR—173

No. 0, 1 and 2 DOMESTIC METERS

SERVICE REGULATOR—107

ROCKWELL

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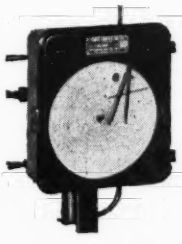
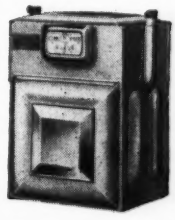
No. 2½, 3 and 4 CAST IRON METERS

ONE



ORIFICE METERS



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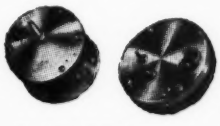

CHART DRIVES

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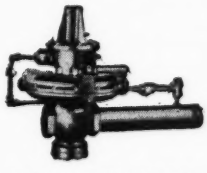

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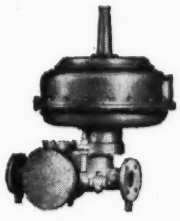

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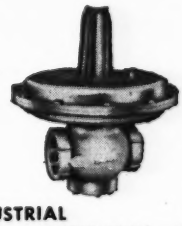

INDUSTRIAL REGULTORS—120

ORIFICE CHART INTEGRATORS

HIGH PRESSURE—015 PILOT LOADED REGULATORS

HIGH PRESSURE—015 INSTRUMENT CONTROLLED REGULATOR

HIGH PRESSURE—015 LEVER AND WEIGHT CONTROLLED REGULATORS

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OCTOBER 1952 • VOLUME XXVIII • NUMBER 10

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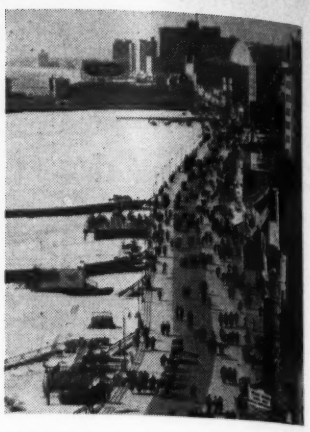

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Gasmen will get a good look at this famous boardwalk at the AGA convention this month (see p. 84).

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CCA NBP

OPS Isn't Dead

Washington

THE OFFICE OF PRICE STABILIZATION, without its utilities branch (which was dismantled when Congress cut the agency's funds), may prove to be an even greater nuisance to utilities in general and the natural gas business in particular than ever before.

That is because the more politically minded OPS legal division now has free rein inside the agency. The legal division long has wanted to become more active in utility rate case intervention, and, although the new Defense Production Act limits the agency to intervention in wholesale cases, more activity in that area is expected by observers here.

In fact, three OPS counsellors—William R. Pierce, Bryce Rea Jr., and Luke R. Lamb—have used the abolition of the utilities branch as an argument for more OPS intervention in rate cases. They say that it has been impossible up until now for the OPS director or his delegates "to reach a reasoned decision."

Several major rate increase cases pending before FPC are subject to OPS intervention, even within the limitations of the new law. Texas Eastern Transmission Corp. has a rate increase request before the FPC to get an additional $41 million annually. OPS already has intervened in this case and the agency is likely by now to have intervened in at least one other leading gas rate increase case.

One of the biggest reasons for such intervention is for the OPS legal division to keep its staff busy. Also, the current political campaign cannot be overlooked, since anyone who is against higher rates for utilities inevitably is a hero to large numbers of Americans, including many businessmen, who don't like to pay higher utility rates in any direction.

International Complications

Washington

THE "INTERNATIONAL" ASPECTS of natural gas—i. e., in relation to Canada on our North and Mexico to the South—continue to create more and more interest in Washington. Where and how it will all end is not yet known, but there are many in the gas industry who follow every development with interest.

It's known that Texas-Ohio has arranged for the necessary $200 million financing, and the Mexican ambassador has confirmed the commitment of the Mexican agency, Petroleos Mexicanos, for export of 200 MMcf per day for 20 years. But the arrangements have hit a snag here, owing to doubts of FPC commissioners of the ability of the Mexican Government to deliver on its promises. On the other hand, Petroleos Mexicanos says that while it has plenty of gas to send north of the border, it won't sign a contract with Texas-Ohio until the company gets an FPC certificate.

What seems to be making the delay is not so much FPC doubt as to Mexico's ability to deliver, but a long memory of what has happened in other years on Mexican-U. S. contracts. The Mexicans soured their international word plenty before World War II by expropriating all U. S. oil properties and never really paying off in anything like a satisfactory manner. Both Department of State and the White House, besides FPC, want to approach such matters as the supplying of gas to American industry, from foreign sources, with caution. The delay will not be fatal, but it could result in greater assurances than simply a contract between Mexico and a U. S. company would carry.

Federal Power Commission is to decide by mid-October whether or not to continue hearing the application of Westcoast Transmission Co. Inc. and four other companies for permits to import and sell gas from Canada. The FPC has heard arguments on a motion of its staff counsel to dismiss the hearings on grounds that none of the companies had obtained authority from Canada to export the gas. Opposing dismissal, Westcoast officials urged FPC to join Canada in investigating Canadian natural gas reserves that might be tapped for the Pacific Northwest, arguing that Canadian permission to build a pipeline would be forthcoming if the Canadian Board of Transport Commissioners finds the company has adequate reserves in the Peace river area of Alberta and British Columbia.

Counsel for Trans Canada Pipe Lines Ltd. urged dismission of the applications without taking evidence on the question of reserves. Trans Canada officials argued that a pipeline depending on Canadian gas would not be able to satisfy an FPC requirement that it be able to assure a steady flow of gas at all times, because Canadian administrative bodies could shut off supplies to the United States during a gas shortage. Furthermore, it was argued, Canada's law does not provide for judicial review of such administrative decisions.

The whole tangled situation led FPC merely to suspend

the hearings and to send Commissioner Dale Doty and assistants into Canada to get further light. The FPC wants more evidence on the availability of Canadian supplies and legal aspects, particularly the law as regards Canadian authority to cut down on gas consumption, or export, etc.

The whole question of importing Canadian gas raises a multitude of other questions—diplomatic, in particular—as to what can happen in case of war (in which, say, Canada was neutral and the U. S. was not), deterioration of relations between the countries (possible, but not very probable) and in other fields. After all, if one administration in Canada or Mexico can make such contracts, does this mean that all future administrations will abide by these contracts, and, if not, what assurances do the Americans have that they will be recompensed for breaches-of-contract? These questions, relatively simple inside a country, are fraught with peril when questions of national and international policy are intermingled with them.

One good reason why FPC (and other American) officials are trying to learn a lot of answers before jumping to a lot of conclusions consists of the battle going on inside Canada itself over the disposition of its gas supply. Quebec provincial leaders do not want their gas supply to depend on imports from the U. S., but would rather have a trans-Canadian pipeline to allow Canadians to use only Canadian gas. Premier Frost, of Ontario, in a recent address, stated: "Our natural gas resources in Ontario now have to be supplemented very largely by artificial gas or by gas imported into Ontario by U. S. pipelines." He said that Canadian consumers, under such circumstances, are "on the end of the line" and have to "take what is left." He declared that "the great markets of central Canada should be used in the development of Canadian gas and oil reserves."

Meantime, plans to export western Canadian gas apparently won the approval of the voters in Alberta, who supported the Social Credit party for its bid for a fifth consecutive term in office. Premier E. C. Manning, its leader, is committed to exploitation of the provincial oil and gas reserves through limited exports. The opposition to exports of natural gas claims that the Alberta reserves are sufficient only for the needs of the province.

Get Back in Line!

TO THOSE GAS INDUSTRY MEMBERS who either find it hard to join in concerted promotional efforts, for one reason or another, or would like to divert activities and monies now being spent by gas associations for such purposes to other (non-competitive) channels, Vice President W. M. Jacobs of Southern California Gas Co. directed some pretty straight, direct words last month.

The following quotation is from his president's address on the occasion of the 59th annual convention of PCGA in Los Angeles:

> Not all of our membership may be aware of the extent to which the association has been used increasingly in the last few years as a medium for concerted, coast-wide, two-fisted sales promotion. This has developed because there are zealots in our industry who are convinced that when individual gas companies join together to do long-range creative planning and sales campaigning in concert, best results are obtained at lower cost.
>
> There are some, however, who do not participate because they consider their conditions different and the joint efforts inapplicable. There are others who do not participate because of indifference.
>
> The AGA, through its promotional bureau and committees, is well embarked on a course similar to ours, and I observe that it meets a measure of similar reactions to its programs. What is the best answer, for all concerned? Should we fare for ourselves strictly as individual companies? How large is the area of our common promotional interest, as gas companies? I suggest that the answer lies in the fact that ours was not formed as a public utility association but as a *gas* association.
>
> If the purposes of our gas industry are to be best served, I urge that our zealots be permitted to continue, even expand, the effective promotional programs coordinated and carried out through our association. That need not mean that all of these programs will fit all conditions in all localities all of the time; and where they do not, they should not be applied. But where they do fit, they should be used and supported heartily. I hope these coordinated promotions will grow and prosper to such an extent that indifference can no longer flourish. For there is no room for indifference in the gas business in the future!

To disinterr an aging cliche: "Nuff sed!"

The Truth Is Coming out

THE WORD IS FINALLY GETTING AROUND: Natural gas is non-poisonous. This belated finding is making its way around the nation's press, and personally, we can't see that's it's going to hurt the industry one bit. In several instances there seems to have been some hesitation to own up to the fact, because it was felt people might become a bit careless in the use of the stuff.

Perhaps so, but today's philosophy is "let the people know," and in this case it's doubtful whether anyone is going to leave the gas jets open just because he knows that breathing pure unburned natural gas won't kill him. It may even discourage some suicides, or turn them to other devices. Breathing the products of incomplete combustion would be less dangerous to other people, because the chance of an explosion is considerably reduced and other fuels are, of course, much handier.

That's the morbid side, of course. But sensible people should be able to treat the fuel intelligently by merely knowing the actual dangers, without having to worry about imaginary bugaboos too.

Air Pollution

Elsewhere in this issue is an article entitled "What Is the Role of the Gas Industry in Air Pollution?" by Edwin L. Hall, director, American Gas Assn. Laboratories Inc., Cleveland, Ohio, which was presented to the Second National Air Pollution Symposium held in Pasadena, Calif. in May of this year. While this meeting was truly "national" in that it dealt with a variety of subjects and attracted speakers and delegates of wide representation and repute it was, if only by location, somewhat slanted toward the famous (or infamous) Los Angeles "smog."

Just prior to the symposium a new theory had been evolved on the origin and formation of important constituents of this smog. The theory, stated as simply as possible, is that unburned or partially burned hydrocarbons released from a variety of sources, are held at relatively low air levels over the area, where, under the catalytic influence of oxides of nitrogen, they combine with ozone to form oxygenated compounds which produce haze, nose and throat irritation, lachrymation, etc.; that the hydrocarbons come largely from automobile engine exhausts and gasoline tankage and filling station evaporation; that the ozone is always present in the air; and that the oxides result from combustion of fuels including natural gas.

This development was of course of considerable interest to the local gas utilities as previous attention has been directed toward sulfur dioxide as one of the major contributors to the objectionable features of this smog, and the natural gas distributed in the area is extremely low in sulfur and therefore a relatively minor source of sulfur dioxide. Furthermore, because of the ease of obtaining smokeless combustion, natural gas obviously was not responsible for smoke or odorous fumes.

Mr. Hall agrees in his paper that oxides of nitrogen will be found in the combustion products of all fuels and tabulates the trace quantities that are produced by natural gas; he goes on to show that the formation of gum particles in manufactured gas is analogous to the reactions believed to produce smog and therefore provides some confirmation of this recent theory. But he concludes that, on a quantitative basis, the oxides of nitrogen contributed by natural gas in the Los Angeles area are probably even less than the small percentage of the total attributed to it by the local investigators.

It seems rather evident that the gas industry should not regard this Los Angeles development as of merely local interest, nor give only passing attention to the problems of air pollution because of the acknowledged cleanliness of gas fuel. This "ozone-oxides of nitrogen-hydrocarbons" theory which, if sustained, would appear to be applicable to other areas also, indicates the need for thorough knowledge of primary combustion and secondary reactions of trace products so that our industry can be prepared, not to dodge or distort the issue, but to have authentic information available so that the matter can be appraised and developed in its true perspective and proportion. And, as previously remarked in this column, a watchful eye should be kept on all developments in atmospheric pollution because the large and increasing quantities of gas burned every day, and the wide variety of industrial and commercial applications which may produce atmospheric contaminants for reasons other than the combustion of the fuel, give our industry a wide exposure to public opinion as well as official probing.

It is certain that increased attention will be given to air pollution control as many areas, not blessed with dependable winds to carry away their "aerial sewage," become larger and more industrialized. Numerous avenues of approach and remedy are being explored and the problem appears to be one for industry, commerce and private citizen alike. It is being studied by many groups of which perhaps the oldest and most thoroughly organized is the Air Pollution and Smoke Prevention Assn. of America, which was founded in 1907 and held its 45th annual convention in Cleveland last June, and publishes from Pittsburgh a quarterly magazine entitled *Air Repair.*

Thermal Microscope

While "high temperature" chemistry has been studied and applied for many years, and has become increasingly important with the development of jet and rocket power, little has been known or observable of what actually happens in a high temperature furnace or other type of reactor. It has only been possible to speculate on high temperature reactions and speeds; they could not be observed.

It is now announced by the research division of the Carborundum Co. that a thermal or high temperature microscope has been developed whereby high temperature processes, such as the formation of silicon carbide, can be directly and continuously watched in the furnace. This apparatus resembles a telescope with provision for adequate illumination, satisfactory mechanical manipulation, elimination of vibration and distortion of the image by convection of heated air, and filtering out of radiation from the heated materials. It is stated that it can be used at temperatures as high as 2000°C (3632°F).

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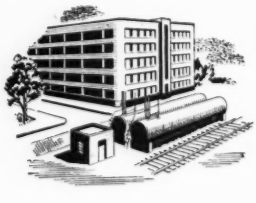

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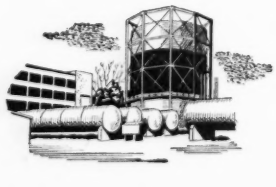

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Plastic Tubing Use Found Practical At Public Service Co. of Colorado

By JOHN F. FUGAZZI
Public Service Co. of Colorado
Denver

In testing plastic tubing for use in underground gas service piping, the Public Service Co of Colorado has extended the tests already made by such companies as the Southern California Gas Co. to include capacity tests, expansion tests, tests with manufactured coal gas, and tests of the effects of sub-freezing temperatures as well as procedures for plastic-to-steel connections. They have also issued an instruction pamphlet (reprinted here) covering all pertinent data on installation, use, and assembly of plastic tubing. The results are highly encouraging. Since the start of the experimental program, about 28,000 ft of the tubing have been installed and to date, all installations have proven trouble-free.

PLASTIC tubing for underground gas service piping was introduced into the operations of the Public Service Co. of Colorado on an experimental basis during 1951. The preliminary investigation was instigated by an anticipated serious need for a steel pipe substitute since steel availability appeared to be very uncertain.

Exclusive

Basic information with respect to the applicability and serviceability of plastic tubing for underground gas service piping was acquired from the Southern California Gas Co. Since this information clearly indicated that "Tenite II" (cellulose acetate butyrate) plastic tubing, which was being utilized by that company, was acceptable for gas service piping, it was decided to use similar plastic tubing for our initial experiments.

Our pipe specifications call for ¾-in. Tenite II plastic tubing, 1.05-in. OD, 0.865-in. ID, Formula #268, flow-medium hard, color-clear, and molded couplings of the same material with an ID measurement of not more than 0.005-in. nor less than 0.003-in. greater than the OD of the tubing.

The plastic service experimental program was divided into four phases of work: (1) Tests to establish procedures for assembly and installation; (2) Capacity tests to determine comparable capacities between plastic and ¾-in. steel pipe; (3) Expansion tests to determine the coefficient of linear expansion of plastic tubing; and (4) Drafting of an instruction pamphlet covering installation of plastic tubing.

The object of these experiments was to predetermine the best methods to use in the assembly of plastic sections and of plastic to steel connections. A model plastic gas service which was set up in the shop was assembled without difficulty and was found to be air tight by conventional air pressure test. Installation procedures as developed are as follows:

The plastic tubing is connected to a steel nipple which is connected to the gas main pipe by the usual methods. Then the plastic tubing is extended underground to a point outside of the building wall and below the surface of the ground where it is connected to steel pipe which is used to complete the service to the meter location, which may be either inside or outside of the building to be served. Plastic tubing is used for underground piping only and never extended to the surface of the ground or through a building wall.

The plastic tubing sections are assembled using an external plastic slip coupling and butyl acetate solvent with dye added *(Fig. 1)*. A molded, tapered coupling is used which eliminates the problems encountered in the use of couplings cut from a larger ID plastic tubing. The ID measurement of a molded coupling can be controlled much closer than can that of extruded plastic tubing. Dye is added to the solvent as a visual aid for the applicator.

The plastic to steel connections are made by the insertion of a steel sleeve into the plastic tubing and the use of a compression pipe coupling. The steel sleeve is cut in 2-in. lengths from 16 gauge steel tubing and is used to reenforce the plastic tubing at the point of compression under the coupling gasket.

Pressure drops were measured in both plastic and steel pipe setups with a differential water column gauge from connections to the piping spaced 100 ft apart over a straight length of piping. These pressure tap connections were located more than 10 pipe diameters from

Fig. 1. Assembling plastic tubing sections using plastic slip covering.

Fig. 2. Inserting a steel sleeve to make plastic to steel connections.

TABLE 1. Capacity Test Results

Pressure Drop (Inches)	Measured Flow ¾-in. Std. Pipe*	Measured Flow Plastic Pipe	Capacity, Plastic over Steel
5	373	432	15.8%
4	325	387	19.1
3	276	326	18.1
2	217	263	21.1
1	148	175	18.2
			(18.5 avg.)

Increased capacity of plastic over steel due to greater I.D. of plastic—16%.
Increased capacity of plastic over steel due to less friction of plastic—2.5%.
*From these results, C in Pole's Formula was determined to be 1224 (avg.) for steel pipe, and 1248 (avg.) for plastic.

any end or elbow to prevent turbulence.

The steel piping was assembled with standard T & C pipe couplings and the plastic piping was assembled with the molded plastic couplings.

Gas flow was measured with a 30B Metric meter.

The specific gravity of the natural gas taken on the day of the test was 0.68.

The test was conducted with approximately 10-in. water column static pressure at the upstream pressure taps. Results are shown in *Table 1.*

A 100-ft length of ¾-in. plastic tubing was assembled using 5, 20-ft sections of plastic tubing, molded external plastic couplings, and butyl acetate solvent.

The tubing was laid out in a straight line with one end of the length connected to steel pipe securely anchored in place, using a compression pipe coupling, and a steel insert sleeve. The other end of the tubing was allowed to float free. This setup allowed the tubing to expand and contract at will and also allowed any change in length of the tubing to be measured at the free end of the pipe.

The plastic was cooled and heated by water flow through the entire length of the tubing. When the hot or cold water had expanded or contracted the tubing to a point where there was no further change in length, the linear measurements were recorded.

The expansion of the plastic tubing when exposed to atmosphere temperature change was also tested but the accuracy of these results is doubtful owing to the difficulty of measuring true pipe temperatures while the tubing is exposed to the sun. The results of these tests are shown in *Table 2.*

The coefficient of linear expansion of Tenite II plastic tubing, Formula 268MH based on the water tests, is equal to 8.8 x 10^{-4} in./ft/°F. The expansion coefficient of mild steel is 7.08 x 10^{-5} in./ft/°F. The test results thus indicate that the plastic tubing will expand in length 12.41 times as much as steel under like temperature conditions *(Fig. 3).*

After the expansion tests had been completed, the 100-ft length of plastic tubing was expanded by the use of hot water and, while expanded, anchored securely at the free end also. Then the tubing was cooled by a flow of cold water through the tubing. After the tubing had been cooled 90°, it was determined that an approximate tension of 289 lbs had been developed in the tubing by the contraction that had taken place. It was also noted that while the tubing was contracted and subjected to this tension force, the plastic tubing did not pull itself out of the compression couplings to which it was connected nor did the couplings slip along the steel nipples to which they were secured.

There was no appreciable permanent distortion noted when the plastic tubing was released after a short period of time.

The tubing was then heated to 140°F by the use of water and both ends anchored in place while the tubing was expanded. The pipe was cooled and left in place over night in tension. The low atmosphere temperature for the night was approximately 30°F. When the tubing was initially released the next morning, the stretch or permanent distortion measured 2¾ in. for the 100 ft of tubing, but after the pipe had been heated and cooled twice, the distortion was reduced to approximately 1 in.

Our plastic service installations for 1951 were intentionally limited to a few hundred services for two reasons. First, we wished to determine whether or not sub-freezing earth temperatures during the winter season would materially affect the plastic tubing and introduce unexpected problems; and secondly, we wished to determine by a winter long test how much the tubing would contract when buried underground and if the plastic to steel connection would give us any trouble. The results of this test will be noted later.

Since our installations for the first year were to be limited, only those installation crews which were to be involved in the initial work were trained. A simple and practical on-the-job training procedure was observed.

Engineering personnel discussed the utilization of plastic tubing with the installation crews and demonstrated the assembly of plastic joints and plastic to steel connections. After the initial service installation was complete, the crews were provided with direct supervision until it was apparent that they could proceed without help.

It has been our experience that the men were fully capable of continuing without further direct supervision after the first day.

After the men had installed a number of services, they were questioned as to their likes and dislikes in the utilization of plastic tubing. Everyone seemed to enjoy working with the material and no one has encountered any major assembly difficulty.

A winter long test has been conducted to determine how much Tenite II plastic tubing would contract when installed in the earth at the average subsurface level of a gas service installation and also to determine if our plastic to steel connection method was sound.

Two 100-ft lengths of ¾-in. plastic tubing made of 20-ft sections and plastic couplings were laid underground along a straight line and adjacent to each other, 18 in. below the surface of the ground.

The two lengths of plastic tubing were securely anchored at one end to a section of 2-in. steel pipe laid at 90° to the

TABLE 2. Expansion Test Results

Temperature Range °F	Linear Change	Factor in Inches/100 ft/10°
47° - 77° (air)	3.6 in.	1.20
60° - 140° (water)	7.0 in.	0.88
46° - 145° (water)	8.75 in.	0.88

plastic tubing and firmly anchored in the earth. The other ends of the plastic tubing lengths were left exposed in a covered wooden box which was partially buried in the earth.

The exposed end of one length of tubing was left unsecured to allow the plastic tubing to expand or contract at will. All of the change in linear measurement of this length of tubing was expected to be measurable at the free end since the other end was rigidly fixed.

The exposed end of the other length of tubing was securely connected by means of a compression pipe coupling and a short ¾-in. steel nipple to a section of 2-in. steel pipe laid at 90° to the plastic tubing and firmly anchored.

The element of a temperature recorder was buried at the subsurface level of the plastic tubing. The element of another temperature recorder was placed inside of the covered wooden box.

During the 5-month test period, a contraction of less than 1/16 in. was measured, all of which was calculated to be attributable to the contraction of the 18 in. of exposed plastic tubing in the covered box. A 29° drop in earth temperatures to a low temperature of 24° was recorded. If the tubing had been free to move, it should have contracted approximately 2½ in. Apparently, the soil gripped the tubing with enough tenacity so that all movement was restricted.

The other plastic length, which was firmly anchored at both ends, showed no movement of the plastic tubing nor the compression coupling at the compression coupled connection.

The initial plastic gas services, which were installed during March 1951, were checked for leakage during March 1952 with a combustible gas leak detector. The leakage crews reported no leakage.

The plastic tubing services were exposed for inspection at a number of different locations and found to be in excellent condition.

A short period exposure test was conducted to determine the effects, if any, of manufactured coal gas on Tenite II plastic tubing. Plastic tubing coupons were placed in our manufactured coal gas distribution piping at a point near the gas plant and at a point 6 blocks away from the plant. These coupons were weighed before placement and after removal.

After a period of about 6 weeks, a coupon was removed from each of the above locations. The coupons removed from the piping close to the plant and the piping 6 blocks away from the plant showed an increase in weight of 12% and 7%, respectively. The coupons were completely discolored, swollen considerably and a great deal softer.

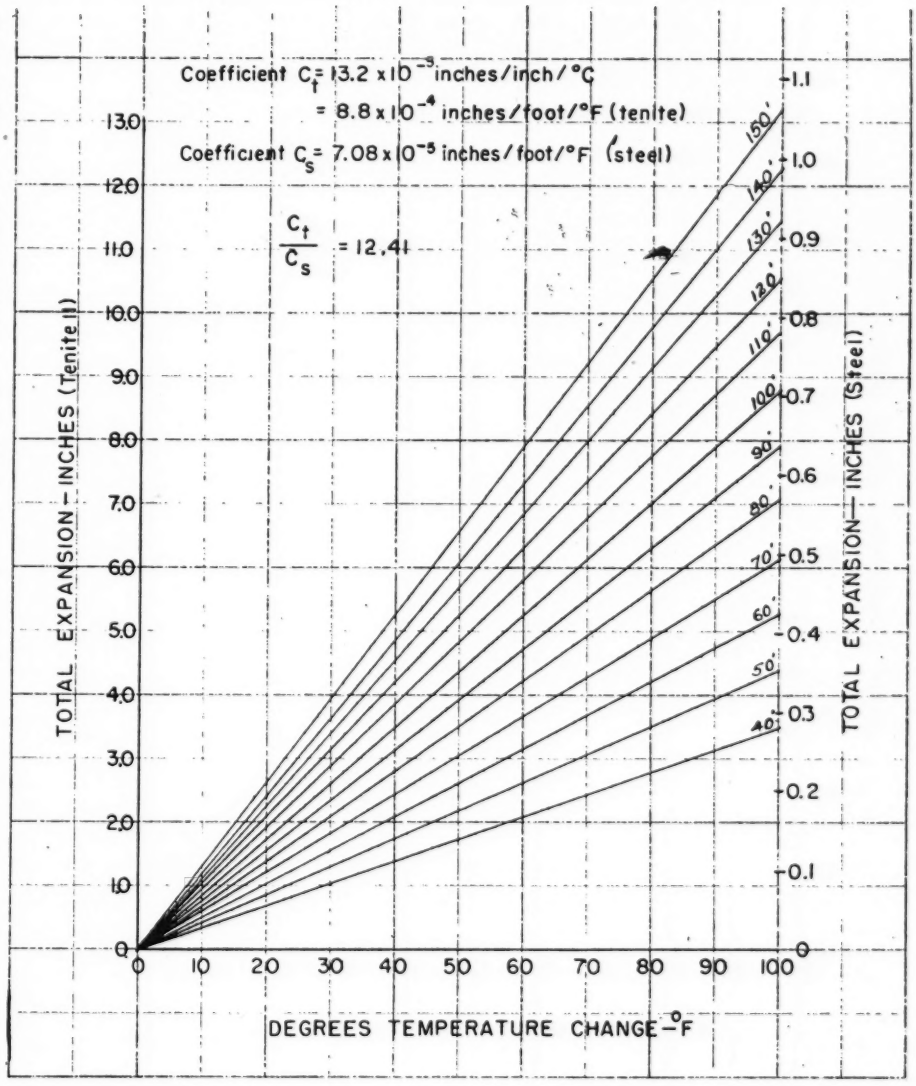

Coefficient C_t = 13.2 x 10^{-3} inches/inch/°C
= 8.8 x 10^{-4} inches/foot/°F (tenite)
Coefficient C_s = 7.08 x 10^{-5} inches/foot/°F (steel)
$\frac{C_t}{C_s}$ = 12.41
TOTAL EXPANSION — INCHES (Tenite II)
TOTAL EXPANSION — INCHES (Steel)
DEGREES TEMPERATURE CHANGE — °F
0 10 20 30 40 50 60 70 80 90 100
0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1
150° 140° 130° 120° 110° 100° 90° 80° 70° 60° 50° 40°

Fig. 3. Expansion curves for Tenite II (formula 268 MH) and for mild steel.

The tests and experimental installations made by personnel of the Public Service Co. of Colorado, together with the engineering data obtained from the Southern California Gas Co., proved to our satisfaction that Tenite II plastic tubing is applicable for underground natural gas service piping, and that our service construction design was practical and sound. The life expectancy of the tubing is still a debatable question. The fact that some 100,000 lineal ft of similar plastic tubing has been in service in California for more than 5 years without the development of any material failures, or even showing any signs of deterioration, leads us to believe that the tubing will perform quite satisfactorily over a long period of time.

The utilization of plastic tubing in our operations presented no difficult operating problems. The assembly and installation of plastic gas services are simple operations which do not require an extensive training course.

Since origination of the experimental program, we have installed 330 plastic tubing gas services utilizing some 28,000 lineal ft of ¾-in. Tenite II plastic tubing. To date, these installations have proved trouble free.

The experience gained by this company in the utilization of plastic tubing for natural gas service piping indicates that the potentialities of plastic materials for this end use are very promising.

We plan to experiment with plastic tubing for service replacement by the insertion method in the immediate future.

INSTRUCTIONS FOR THE USE OF PLASTIC TUBING

After the plastic experiments had been completed, an instructive pamphlet on use of plastic tubing for gas services was drafted and issued to operating personnel.

The pamphlet covered all the pertinent information with regard to the use, assembly, and installation of plastic tubing gas services and the key points that should be observed to insure good construction. The details are outlined below:

1. Plastic tubing (¾-in. nominal, 1.05-in. O.D., 0.865 I.D.) may be used for gas service piping in place of ¾-in. nominal steel pipe in the pounds low pressure systems (3 psi to 15 psi), and in the majority of cases in place of 1-in. and 1¼-in. nominal steel pipe in inches low pressure systems (10-in. WC to 83-in. WC). Generally, a ¾-in. plastic service connected to an inches low pressure system will supply adequate gas for a single family dwelling.

2. Plastic tubing shall not be used for installation in abrasive soils such as rock, etc.

3. Plastic tubing shall be laid on level, undisturbed, or well compacted earth. This rule shall specifically apply to all plastic tubing laid beneath roadways.

4. Plastic tubing shall be "snaked" into the trench during installation.

5. Plastic tubing shall be connected to a short ¾-in. steel nipple at the main and a ¾-in. steel pipe outside of the building entrance with ¾-in. compression pipe couplings. A metal stiffener sleeve shall be inserted into the tubing to reinforce the plastic tubing at the point of compression when the tubing is to be coupled to steel pipe by means of a compression pipe coupling. Standard practice for termination of plastic tubing below ground and outside of building entrance and its connection to ¾-in. steel pipe is outlined below:

(a) Front, subsurface entry.

A 4-ft section of ¾-in. steel pipe with an 18-in. long "back-up" steel bar or pipe welded to it at a 90° angle near its midsection shall be connected to the plastic tubing to complete the service piping through the building wall. Purpose of the back-up bar is to prevent turning the steel pipe in the event of wrench operation at the service terminal.

(b) Side, subsurface entry.

A 2-ft section of ¾-in. steel pipe shall be connected to the plastic tubing ahead of the ¾-in. steel fittings and pipe to be used to complete the 90° turn and service piping through the building wall.

(c) Aboveground entry.

A 2-ft section of ¾-in. steel pipe shall be connected to the plastic tubing below ground and ahead of the ¾-in. steel fittings and pipe to be used to extend the service to the surface of the ground and to the meter location.

6. All underground steel fittings and pipe connected to plastic service piping shall be wrapped with the standard hot applied tape-like pipe coating. The coating shall overlap a few inches of the plastic tubing at all points of plastic-to-steel connection. Plastic tubing will burn and support combustion. Therefore, care should be exercised in the handling of the heating torch to prevent damage to the plastic tubing. It is recommended that when possible, pipe coating be applied to all plastic-to-steel joints before the release of natural gas into the service.

7. Plastic services shall at no time be left exposed in an open trench during the absence of installation crews.

8. Plastic-to-plastic assembly: The assembly of plastic tubing by means of a plastic coupling:

(a) The plastic tubing and the coupling should be exposed to the same temperature conditions for a reasonable length of time before assembly. Otherwise, assembly trouble will be experienced because of too much or too little clearance between the surface of the tubing and the interior of the coupling, a result of dimensional change due to temperatures.

(b) The plastic tubing and the plastic coupling should be wiped clean of all foreign substances before the application of plastic solvent.

(c) The end of the tubing which is to be inserted into the coupling should be filed to remove all exterior surface roughness.

(d) Apply the plastic solvent (butyl acetate) *freely* and *simultaneously* to the two surfaces to be engaged. The solvent should be applied freely with a very light wiping action to spread the solvent uniformly over the surface. Do not rub the surface of the tubing or coupling with the brush any more than is necessary to spread the solvent. Heavy brushing after solvent application will displace the liquefied plastic surface and a poor joint assembly will result.

(e) *Immediately* after the solvent has been applied to the surfaces to be engaged, insert the tubing into the coupling with a *straight movement without rotation* until the tubing is butted against the centering ring of the coupling. The union should be allowed to cure for 5 minutes before it is handled. Another tubing section can be added to the opposite end within 2 to 3 minutes if care is exercised in the handling of the plastic lengths so that undue strain is not placed on the previous assembly. In all cases, where such a plastic connection is made with the union under stress due to mis-alignment or otherwise, the plastic joint should be held rigid after insertion for the cure period to prevent movement of the tubing inside of the coupling.

9. Plastic services shall be air tested in the same manner as steel services.

10. Plastic services shall be identified in the field by a metal band placed over the service pipe inside of the building wall ahead of fittings and valves, on inside water meter sets, and ahead of the service terminal valve on outside meter sets. The words "Pl. Tubing" shall be stamped into the metal band.

11. Plastic tubing cannot be located by means of an electronic pipe locator. Therefore, each plastic service laid should be accurately measured for location records. Where possible, plastic service location in the field should be marked by a symbol cut into the concrete curb face above the service pipe. It is recommended that the letter "T" be used for this purpose.

12. Future gas leak survey of plastic service piping will call for the observance of extra precaution in drilling holes for test probe insertion to avoid damaging the plastic tubing with the drill steel.

13. Services accidentally punctured by a drill steel, or otherwise, can be repaired by using a compression pipe coupling and two insert sleeves. A short plastic nipple and plastic coupling can be used with the other fittings where extra pipe is needed. A plastic nipple and two plastic couplings can be used to make repairs, if a sufficient amount of the service is exposed so that the tubing can be bent and inserted straight into the coupling.

This is the Erie street control room showing control panel, the 10- by 12-ft map of transmission lines, and dispatcher's desk.

Single Control Room Integrates Entire System

By JOHN J. CRILLY
Elizabethtown Consolidated Gas Co.
Elizabeth, N. J.

Exclusive

ONE control room, located at our Erie street plant, is the nerve center of our operation since the changeover to natural gas. All operations are directed from this room, and all pressures and distribution of gas are controlled from here.

Two years ago the project was started: The territory was mapped out to determine just where gauges and controls should be located and the room was planned. An artist was engaged to draw a map of our territory showing where the transmission lines are located and equipment was ordered and construction gotten under way. Originally, the system was installed in the plant engine room but upon completion of the control room, the panel board was erected and the controls and telemeter gauges were moved, one by one, into their new quarters.

There are three stations which receive gas from the natural gas pipeline: Grandview station in Raritan township, Cloverleaf station at Woodbridge, and the third and largest station located at the Erie street plant. Each station has two separate buildings, one for the use of the natural gas pipeline company for its controls, meters, and governors, and the other which houses our reducing governors, meters, remote controls, telemetric gauges, odorizing equipment, and foggers. A manual toggle switch at the control room regulates all pressures both at the above stations and on all distribution gas mains.

At Rahway and Westfield, there is an emergency governor to transfer the gas from the high pressure line to booster lines if for any reason a line has to be shut off. The control room dispatcher has complete control of the pressures at all times. The amount of gas passing through the meters at each station is automatically recorded on the panel board in the control room. The height of the Westfield holder (indicating the quantity of gas in the holder) is also automatically transmitted to a recorder in the control room. From this point the dispatcher can automatically fill or shut off the holder to any desired height. In case of emergency when the holder reaches a predetermined height, the flow of gas is automatically shut off.

A remote control is installed at the South street station to regulate the pressure in the city of Elizabeth if necessary. Telemetric gauges are installed at South street and at 16 West Jersey street to record the city pressure at the control board.

On each of the gas lines leaving the plant a telemeter records the pressure and remote controls on the governors regulate the pressure. Ten other telemeters are located in Hillside, Union, Rahway, Westfield, Carteret, Perth Amboy, and Metuchen.

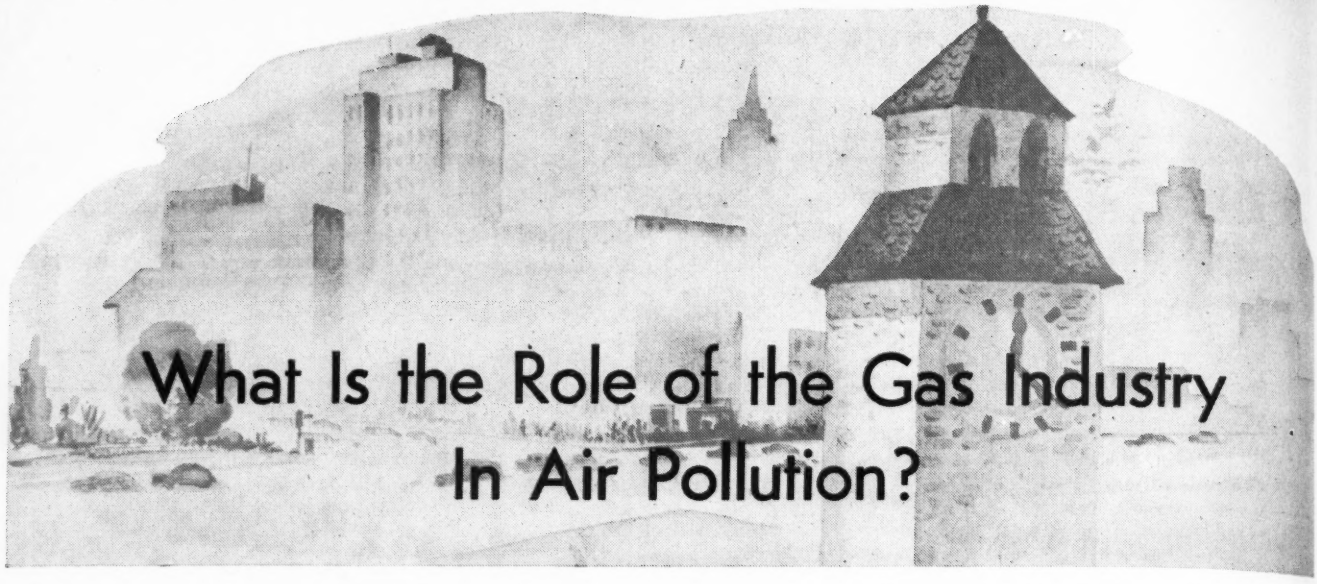
Each station has a telephone and there are 36 telephones lines now being used with cable installed for 64 lines for the future. On the dispatcher's desk there are three direct telephone lines, one to the radio dispatcher at Green Lane, one to the dispatcher at the natural gas office in Linden, and the third phone is a direct line to the outside.

On each recorder in the control room at the plant an alarm rings a bell if the pressure goes beyond the high and low limits for which they have been set. This also lights a signal on each gauge so the dispatcher may tell at a glance from which gauge the signal comes. On the panel board there are two indicating gauges to indicate the steam pressure from the engine room and also the boiler feed pressure. A set of signal lights on the wall of the control room indicates whether the airplane lights on the holders are in operation. In the event that one of these lights fails to function, a corresponding signal light automatically turns on.

Three calorimeters recording the Btu's in the gas and one specific gravity recorder are installed in the same room. An instrument on top of one of the holders measures wind direction and velocity which also is recorded on the panel board.

A radio and an inter-communication system are located on the dispatcher's desk. The radio is used to contact the other departments having this equipment, and also 26 cars equipped with 2-way radios. The inter-communication system is connected to the boiler house, engine room, gas generator house, and the governor house.

An automatic generator is being installed at the plant, which in the case of a power failure will turn on and supply power to operate the lighting system, radio and gauges.



What Is the Role of the Gas Industry In Air Pollution?

By EDWIN L. HALL
Director, AGA Laboratories

THE principal products of combustion of fuel gases are colorless and odorless gases. Complete combustion with the theoretical amount of air yields carbon dioxide, water and nitrogen. Under normal conditions some excess air is supplied and the flue products consist of carbon dioxide, water, oxygen and nitrogen. All of these products are generally recognized as harmless gases.

When insufficient air is supplied, either for the purpose of producing furnace atmospheres or because of inadequate aeration of appliances, large amounts of carbon monoxide and of hydrogen may be produced. *Fig. 1* indicates the variation in these major constituents as related to the amount of air supplied for the combustion of natural gas. Curves for other gases will be parallel to those for natural gas differing only because of the hydrogen-carbon ratio in the gas.[1]

Table 1 and *Fig. 2* indicate the carbon dioxide produced in the products of combustion of commonly used domestic appliances. These analyses are on the commonly accepted dry basis as compared to *Fig. 1* where the water vapor was shown uncondensed and as a part of the flue gases. It will be noted from *Fig. 2* that there is a substantial amount of excess air present in these flue gases and that ordinary appliance operation is well displaced from the area of incomplete combustion.

Trace products of combustion of fuel gases include oxides of nitrogen, aldehydes, organic acids, and if sulfur compounds exist in the fuel, oxides of sulfur. These trace products are normally not determined by flue gas analyses and conditions of improper venting have called them to the attention of the gas industry only occasionally in the past. As we will show later, we believe that attention has properly been called to the oxides of nitrogen by the Los Angeles investigations relating to smog control. The sharp penetrating odor which usually accompanies and serves to identify partially burned fuel gases is commonly attributed to the products of incomplete combustion, chiefly aldehydes. Technicians in gas laboratories and gas appliance servicemen have long recognized the presence of aldehydes as an indication of incomplete combustion. When adjusting appliances, no tests for traces of carbon monoxide are made until such odors have been eliminated. It should be emphasized that supplying adequate air for combustion will not always correct this condition, as unbalanced and uneven distribution of this air to the burner flames may be occasioned by burner or appliance design and thus permit incomplete combustion to occur in some part of the flame.

Table 1. Carbon Dioxide in Flue Products From Domestic Gas Appliances

Ranges	2-5%
Water Heaters	4-7.5%
Room Heaters	3-8%
Refrigerators	0.5-1.0%
Central Heating Furnaces and Boilers	7.9%

As shown by *Table 2* domestic gas appliances may produce 15 to 50 parts per million of oxides of nitrogen and 0 to 11 parts per million of aldehydes in the products of combustion. Because these appliances operate at relatively low temperatures, the oxides of nitrogen tend to be low and the aldehydes are normally minimized by the common practice of supplying excess air to the appliance.

The data for *Table 2* were supplied by the Southern California Gas Co. The methods of analysis used are shown in *Appendix A.* The joint Research Committee of the Institution of Gas Engineers and Leeds University in England[2] confirm these results. Their investigations showed that blue or Bunsen flames produced about 40 to 50 ppm of NO and that incandescent or yellow flame burners produced from 50 to 100 ppm of NO in the products of combustion. Yellow flame burners are not commonly used in this country so that, allowing for difference in methods of analysis, this British work aids in establishing the order of magnitude of oxides of nitrogen production by domestic gas appliances.

Assuming 50 ppm of NO_x, 5 ppm of aldehydes in flue gases containing 100% excess air and an average domestic and commercial use of 318,000 Mcf or 7,600

*Presented at Second National Air Pollution Symposium, Pasadena, May 5 and 6, 1952.

tons of natural gas per day the general public emissions might be 19.25 tons of NO_2 and 1.25 tons of aldehydes. While these figures are substantially less than those estimated in the Third Interim Report on the Smog Problem in Los Angeles County, it must be remembered that the total amount of oxides of nitrogen is still significant and that this is a minor correction to the total estimate of the Third Interim Report.

The production of oxides of nitrogen involves an equilibrium reaction which goes toward the formation of the oxides as the reaction temperature increases. Therefore, the most favorable conditions for production are high temperature in the combustion chamber and then rapid cooling of the combustion products so that the reaction does not have an opportunity to reverse. Aldehydes, ketones, etc., are intermediate or breakdown derivatives of the fuel hydrocarbons and their formation is encouraged when there is an insufficient amount of combustion air or incomplete mixing of the fuel and the combustion air. Their persistence and appearance in the final combustion products, even when there is excess combustion air, is caused by their escape from the flame region before the combustion is completed, or the cooling of the partially burned gases by impingement on a cold surface.

It has been found possible to produce concentrations of greater than 1% or 10,000 ppm of nitric oxide from combustion in a regenerative pebble furnace designed for the purpose. Operations were at temperatures of 2100° C followed by a very rapid quenching or cooling of the products.[4] Fortunately, in domestic gas appliances neither these high temperatures nor the quick cooling of the products are present.

Oxides of nitrogen in combustion gases have caused trouble when these gases were used for purging pipe lines in paint and lacquer factories producing gumming in the lines. In one case an internal combustion engine was used to make products of combustion which were in turn compressed to 150 psi by a compressor driven by the engine. Under these heavy load conditions the oxides of nitrogen were reported as 2000 ppm (a more common figure is 500 ppm for gas engines) and the oxygen about 0.5% by volume. In a second plant operated by the same company, the products used for purging were produced by direct flame combustion and averaged about 100 ppm of oxides of nitrogen and a trace of oxygen and the troubles were not nearly so great. Investigations in the gas industry have shown that oxides of nitrogen tend to increase with the temperature of combustion so that industrial furnaces, internal combustion engines, and other relatively high temperature processes under certain conditions may produce several hundred parts of oxides of nitrogen per million cubic feet of products. It should not be assumed that all such processes do produce large amounts of oxides of nitrogen but the information available indicates that these are the uses that deserve attention if profitable results in the reduction of oxides of nitrogen are to be attained.

Aldehydes and organic acids may be definitely related to incomplete combustion. Such incomplete combustion may be deliberately developed by the production of reducing atmospheres in industrial processes or they may be the result of flame inpingement in appliances or of incomplete and non-uniform combustion in internal combustion engines or other processes. *Table 3*[5] shows the results obtained when operating to produce various types of furnace atmospheres. Note that over a thousand ppm of total aldehydes and acids were produced when using butane with 49% aeration.

The results of *Table 3* were obtained where no external heat was provided for the unit. Other tests were made with the aeration so low (26 to 29.4%) that external heat was required to maintain

Table 2. Trace Components in Products of Combustion Domestic Gas Appliances Using Natural Gas

	Oxides of Nitrogen (as NO_2)			Aldehydes		
	Parts Per Million	Pounds Per Ton of Gas	Pounds Per 100 Million Btu	Parts Per Million	Pounds Per Ton of Gas	Pounds Per 100 Million Btu
Bunsen Burner	21	3.0	7.0	2	—	—
Range Top Burners	22	1.3	3.0	—	—	—
Range Oven	15	2.0	5.0	11	1.0	2.0
Water Heater, 20 gals	25	2.0	5.0	—	—	—
Water Heater, 100 gal	45	4.0	9.0	8	0.5	1.0
Floor Furnace	30	3.0	7.0	3	0.2	0.5
Forced Air Furnace	50	4.0	9.0	—	—	—
Steam Boiler 10 mm Btu/hr:						
Low Fire	40	6.0	14.0	5	0.5	1.0
High Fire	90	7.0	16.0	—	—	—

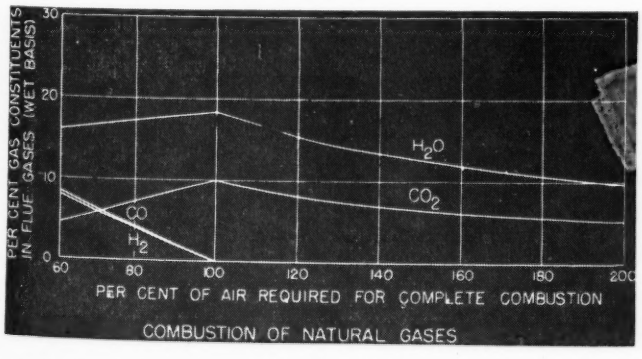


Fig. 1.

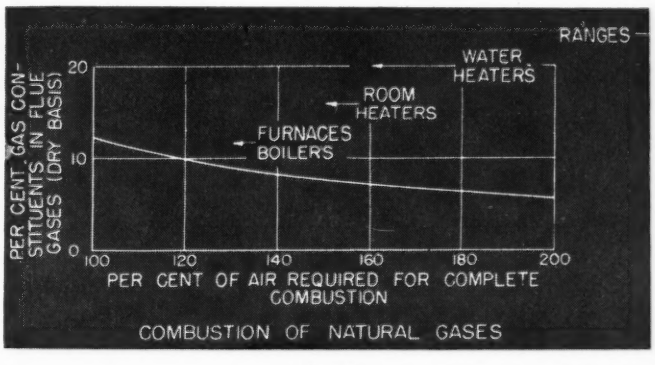


Fig. 2.

Table 3. Analysis of Products of Incomplete Combustion

Fuel Gas	Natural	Natural	Coke Oven	Butane
Aeration %	84.2	67.5	49.5	49.0
Gas Analysis %				
CO_2	9.2	3.4	4.6	4.3
Illuminants	—	0.1	0.3	2.0
CO	3.9	9.6	11.4	13.5
H_2	3.6	9.9	15.4	9.6
CH_4	0.1	0.3	0.4	3.5
N_2	83.2	76.7	67.9	67.1
Total	100.0	100.0	100.0	100.0
Btu per cu ft of product gases	25	63	97	160
Trace components ppm				
Formaldehyde	0.22	133.0	30.2	842.0
Acetalhyde	0.30	0.8	2.0	52.0
Formic Acid	2.20	28.2	9.7	208.0
Total	2.72	162.0	41.9	1102.0

Table 4. Formation of Gum Particles in the Vapor Phase

Boiling Range of Fraction of Gas Condensate ° C	Dispersing Medium	Particle Formation				
		NO Alone	NO $+O_2$	NO_2	N_2O $+O_2$	O_2 Alone
Below 75	Nitrogen	*	**	******	0	0
75-120	Nitrogen	0	**	*****	0	0
75-120	Hydrogen	*	**	.....	....	....
120-160	Nitrogen	0	*	***	0	0
120-160	Hydrogen	0	*	.....	....	....
160-200	Nitrogen	**	**	*****	0	0
Whole Condensate	Nitrogen	***	****	******	0	0

combustion. Under these conditions of high ambient temperature combustion (1800° F) the aldehydes decreased to less than 0.1 ppm.

The lack of specific interest in these trace components of gaseous combustion has previously discouraged any attempt to further reduce them by appliance design or by process application. Investigations in Los Angeles, added to occasional occurrences elsewhere, will, I believe, justify a further and more complete investigation of the conditions that produce these components.

The investigations of A. J. Haagen-Smit[6] and of Martin Shepherd and his co-workers[7] are of particular interest when considered in relation to the vapor phase gum problem that has excited the interest of the manufactured gas industry during the last 20 years.

A. J. Haagen-Smit showed conclusively that in the presence of sunlight oxides of nitrogen and hydrocarbons will produce fumes, crop damage, eye irritation and rubber cracking. Mr. Shepherd and his co-workers verified this work and produced what they called a "witches' brew" that paralleled the properties of natural smog. This "witches' brew" was produced by six hydrocarbons introduced to the test chamber together with the ozone and nitrogen dioxide in the presence of ultraviolet light. The hydrocarbons previously found in the concentrates of actual smog were:

Ethylene	1,3-Butadiene
Propylene	n-Hexene
Isobutylene	Benzene

Each of these present to the approximate extent of 1.2 ppm. The other constituents, ozone and nitrogen dioxide, were present in 0.5 ppm and 0.3 ppm, respectively.

This work is particularly interesting when related to the work of Jordan, Ward, and Fulweiler[8] on vapor phase gum. In their investigations, fractions of gas condensate were vaporized with nitrogen or hydrogen and nitric oxide, nitrogen peroxide and nitrous oxide, or oxygen was added. Where nitric oxide was used, 0.8% oxygen was later added. The number of particles formed per millimeter of gas was counted after different periods of time. In *Table 4* the results are summarized, the number of asterisks indicating roughly the approximate ratio of the number of gum particles.

Proceeding further they found that in all probability vapor phase gum would not be formed in sufficient quantities to cause trouble with pilot orifices in the distribution of manufactured gas were it not for the fact that the reaction $2NO + O_2 = 2NO_2$ is strongly catalyzed by certain conjugated diolefins such as butadiene and cyclopentadiene which are normally present in manufactured gas. The mechanism of the reactions involved in the catalytic oxidation of nitric oxide to nitrogen peroxide and the subsequent reaction of the nitrogen peroxide to form gum particles is extremely important.

In order to determine whether the reaction with oxides of nitrogen was confined to the reactive unsaturated hydrocarbons in gas, the effect of nitrogen peroxide was observed in a large number of compounds which have been isolated from the products of the carbonization of coal or are very closely related to compounds which have been isolated. These compounds were vaporized in nitrogen. The mixtures were examined for particles, nitrogen peroxide was added, and the number of particles formed was counted after different intervals of time. In no case were particles observed before the addition of the nitrogen peroxide. In all cases in which organic compounds were used, particles were formed in varying numbers. The compounds used included: ethane, butane, decane, ethylene, amylene, butylene, decene, butadiene, benzene, mesitylene, toluene, xylene, acenaphthene, anthracene, naphthalene, cyclohexane, cyclohexene, cyclohexadiene, tetrahydronaphthalene, acetonitrile, benzonitrile, aniline, pyrrole, pyridine, picoline, carbon disulfide, phenyl mercaptan, thiophene, phenol, cresol, naphthol, benzoic acid, anthranilic acid, butyraldehyde, and methyl ethyl ketone.

In a number of cases the gas mixtures were passed through pilot light orifices to determine if the particles formed would cause stoppage in a way similar to that observed with natural gums. The particles formed from amylene, pyrrole, pyridine, picoline, and carbon disulfide stopped the pilots in less than 17 hours. Those formed from benzene, toluene, and xylene caused outages in 30 to 45 hours. The quantity of gum on the flow control needles responsible for the stoppage varied from 0.002 to 0.05 mg.

It is interesting that the work with manufactured gas indicated[8] that NO would produce gums in such limited

quantity as to indicate that traces of O_2 might be responsible since it further indicated that NO would be oxidized to NO_2 and that this reaction was relatively fast when catalyzed by butadiene. It further showed that NO_2 would produce gum in the vapor phase from a wide variety of hydrocarbons and related products.

Gum Filters

This gum problem was recognized by the manufactured gas industry and American Standard requirements specified the installation of gum filters on the pilots of all manufactured gas appliances. As the result of this work the American Standard listing requirements for gum protective devices, effective Jan. 1, 1946, and developed during studies started in October 1941, specify that the test gas used in continued performance tests on the filters to be listed under these requirements shall contain:

Butadiene	1.2% by volume
Oxygen	0.8% by volume
Illuminants other than butadiene	None
Nitric oxide	80-120 grams per million cu ft (2-3 ppm)
Components inert to gum formation	98.0% by volume

It is further specified in these standards that the resulting mixture shall then be passed through a reaction chamber which will permit the gas to age at least two hours before entering the test manifold.

These test procedures followed studies that indicated that with the above concentrations these gums formed in the vapor phase and grew to definite particles in a normal time of about two hours after which the particles tended to coalesce and settle out of the gas. It should be understood that this growth period is a function of the dilution of the reactants, and hence may differ widely in different systems. The similarity is based on the sequence, not the timing, of a series of reactions:

1. 2 NO+ O_2+ catalyst → $2NO_2$.
2. NO_2+ hydrocarbon → gum or smog molecule.
3. Gum molecules grow by colloidal accretion to colloid or aerosol suspensoids.
4. Colloid suspensoids continue to coalesce and grow to macro-particles, which fall out of the system by gravity.

Whether stage (3) in the sequence is reached in two hours, two days or two weeks depends upon the dilution. But the time is of some importance, because, if sufficiently slow, more time will be given for dispersion thus avoiding troublesome concentrations of smog.

Analytical methods for the determination of oxides of nitrogen have been developed by Fulweiler[9], Shively[10], Shaw[11], Hollings[12], and other works. The selection of the proper method is sometimes difficult for unknown gases. The presence or absence of catalysts such as butadiene or cyclopentadiene will produce gross variations with some of the methods. In 1938 the AGA chemical committee recommended a method called the "Universal Method"[1]. For this reason it is important to know the method of analysis that may have been used when discussing any results. Various methods are compared by Altieri[13] and Shnidman[1].

Removal Methods

In the gas industry two methods were developed for removing NO. The U.G.I. method used iron sulfide[8] and the Koppers[14] method used a corona discharge to oxidize the NO to NO_2 by ozone, the NO_2 then being removed by oil scrubbing.

A review of this gas industry work indicates that, except for the absence of ultraviolet radiation and of ozone, all of the conditions causing vapor phase gum in manufactured gas are duplicated by the conditions causing smog in Los Angeles. Unsaturated hydrocarbons are present in manufactured gas and are nor-

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Appendix A. Determination of Aldehydes in Combustion Products

This colorimetric method for formaldehyde is based on the method of E. C. Crocker[1]. The range of the method is from 2-40 micrograms of formaldehyde in the absence of other aldehydes.

Reagents

I. Conc. H_2SO_4, reagent grade.
II. 0.1% guaiacol solution. Eastman "practical" is satisfactory.

Procedure

1. Evacuate a two-liter round-bottom boiling flask fitted with a rubber stopper and glass stopcock.
2. Admit the sample using a closely coupled glass capillary extension on the stopcock if necessary.
3. Admit through the sample tube and stopcock 5 ml of water.
4. Swirl the contents for 5 minutes to absorb the formaldehyde.
5. Add 3 drops of reagent II and swirl.
6. Gradually, with cooling, add 15 ml of reagent I.
7. Measure the optical density of the pink color against a blank at 510 millimicrons[2].
8. Calibrate the spectrophotometer using aliquots of a standard formaldehyde solution made from commercial 37% solution.

[1]Industrial and Engineering Chem. 17, 1158 (1925).

[2]Aldehydes other than formaldehyde give an orange color with an optical density maximum near 390 millimicrons.

Appendix A. Determination of Oxides of Nitrogen in Combustion Products

The phenoldisulfonic acid method described on page 354 of Jacobs* was used with some modification.

Reagents

I. Phenoldisulfonic acid prepared as directed in Jacobs*.
II. Approximately 0.1N H_2SO_4, reagent grade.
III. Approximately 1N KOH, reagent grade.
IV. Concentrated NH_4OH, clear, reagent grade.
V. Approximately 0.1M $KMnO_4$, reagent grade.

Procedure

1. Evacuate a 500-ml round-bottom boiling flask fitted with rubber stopper and glass stopcock.
2. Admit sample using a close coupled glass capillary tube extension if necessary.
3. Draw into flask through sampling tube and stopcock approximately 5 ml of reagent II containing one drop of reagent V.
4. Swirl the contents of the flask occasionally to wet the walls during a one-hour period. Add additional reagent V if necessary to keep color pink.
5. Transfer contents of flask to a 100-ml beaker using 10 to 15 ml water.
6. Make just alkaline to litmus with reagent III.
7. Cover with a watch glass and evaporate to nearly dryness on a hot plate and continue to dryness on a steam bath or with a heat lamp.
8. Thoroughly rub one ml of reagent I into the hot residue and let cool five minutes.
9. Transfer to a 25-ml graduate with water.
10. Add approximately 10 ml reagent IV and dilute to 25 ml.
11. After 5 to 15 minutes determine the optical density at 410 millimicrons with a calibrated spectrophotometer using a water blank. Calibrate the spectrophotometer using this procedure with aliquots of KNO_3 solution (100 micrograms/ml) as a source of known NO_2 content.
12. Run a blank on the reagents and correct the results obtained in step 11 accordingly.
13. Calculate the oxides of nitrogen in the sample with the formula:
Micrograms of NO_2 liters of gas sample = Milligrams of NO_2 per cubic meter of gas sample.

*The Analytical Chemistry of Industrial Poisons, Hazards and Solvents, Vol. I, 2nd Ed. (1949), Interscience Pub., Inc.

mally grouped under the term "illuminants." Investigations have shown that they are present in the Los Angeles atmosphere from the evaporation of gasoline and from motor exhaust.

Oxides of nitrogen are present from domestic, commercial and industrial processes, and from motor exhausts. The time for reaction is provided by the atmospheric inversion conditions as so completely described in the Third Interim Report on the Smog Problem in Los Angeles County by Stanford Research Institute, 1950. A review of *Table 2* indicates that ordinary domestic appliances produce less oxides of nitrogen than was estimated by the report. However, the amount produced by certain industrial applications may exceed the estimates in that report.

The weight of the evidence, therefore, supports Haagen-Smit and Shepherd in the conclusion that the community must either reduce the oxides of nitrogen or the hydrocarbons, or the residence time.

Residence time in the Los Angeles basin cannot be modified economically by presently known methods. The amount of oxides of nitrogen, aldehydes, or hydrocarbon produced by ordinary domestic or commercial gas appliances is probably about the minimum possible. Hence, any major reduction in oxides of nitrogen as produced by these appliances is probably impractical and may be impossible. All investigations have shown, however, that these appliances produce far less of these components than may be produced by industrial furnaces or internal combustion engines.

Attention therefore should be directed to those specific applications in which by some reasonable modification of process or design the oxides of nitrogen and hydrocarbons and aldehydes discharged to the atmosphere might be appreciably reduced.

BIBLIOGRAPHY

1. Gaseous Fuels, Shnidman, American Gas Assn.
2. Corfield, Guy, Southern California Gas Co.
3. Twenty-eighth and Thirty-eighth Reports of the Joint Research Committee of the Institution of Gas Engineers and Leeds University.
4. Gilbert, Nathan, and Daniels, Farrington. Ind. and Engr. Chem., September, 1948.
5. Combustion of Gas with Limited Air Supply, research bulletin No. 15, American Gas Assn. laboratories.
6. Haagen-Smit, A. J., Engineering and Science, December, 1950.
7. Shepherd, Martin, Rock, S. M., Howard, Royce, and Stormes, John. Analytical Chemistry, October, 1951.
8. Jordon, C. W., Ward, A. L., and Fulweiler, W. H. Gum Deposits in Gas Distribution Systems, Vapor Phase Gum, Industrial and Engineering Chemistry, September, 1934, October, 1934, October, 1935.
9. Fulweiler, W. H., AGA Proceedings.
10. Shively, W. L., AGA production and chemical conference (1940).
11. Shaw, J. A., Ind. Eng. Chem. Anal. Ed. Vol. 8, p. 162 (1936).
12. Hollings, H., Communication No. 154, Inst. Gas Engrs. (England) 1936.
13. Altieri, V. J., Gas Analysis and Testing of Gaseous Materials, Published by American Gas Assn.
14. Shively, W. L., and Harlow, E. V., Trans-Electrochem. Soc. Vol. 69, pp. 495-517.

ceramic coatings

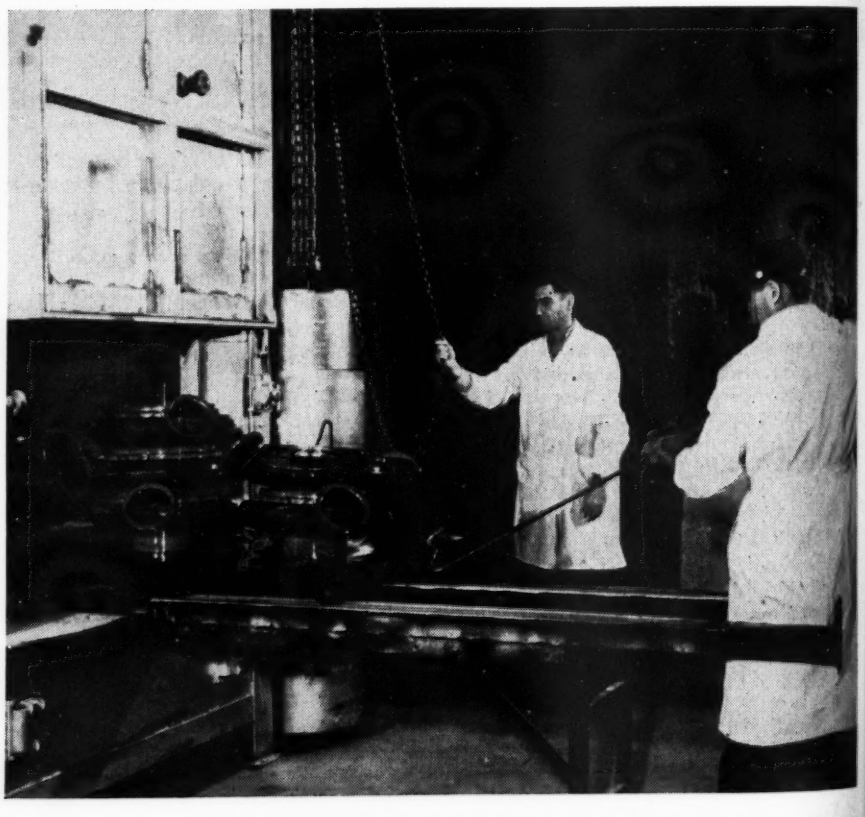
Longer Life for Jet Engine Parts

THE problem of longer life for jet engine "hot parts" is being solved in the Solaramic pilot plant of Solar Aircraft Co., San Diego, Calif., by a newly developed type of ceramic coating (Solaramic), which is fused to the parts in a gas-fired furnace. Actual-service tests show that the coated parts outlast uncoated ones in hours of life by 300% and better. Rather than insulating the metal against heat as in regular porcelain finishes, the new coating protects the part against oxidation and corrosion. In addition, it reduces hot spots, cracking and warping of the metal and increases fatigue life and improves gall resistance under high-temperature conditions. The new coating not only increases the life of critical alloys but will, in many cases, permit using less-critical materials for the same jobs. It gives considerable promise of opening an entirely new industry.

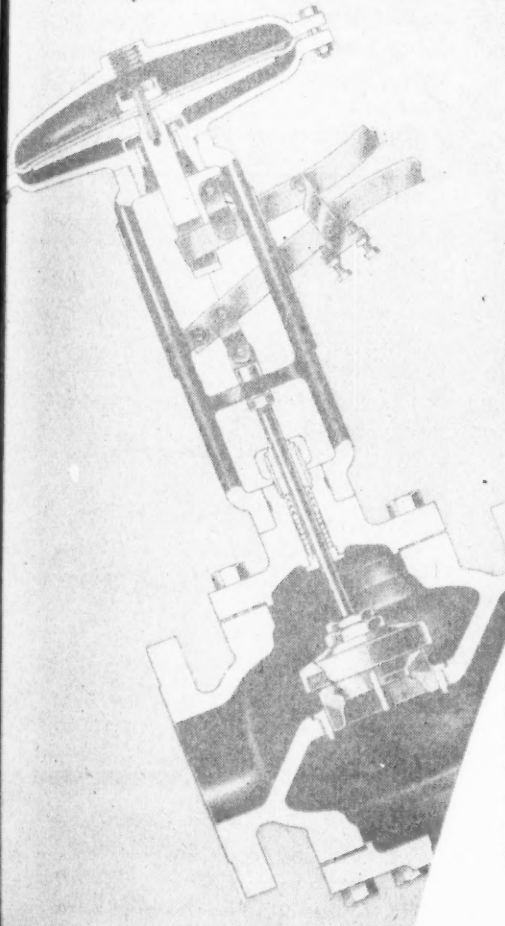
The techniques of applying the coatings are substantially the same as those used in porcelain enameling. The main difference is in the composition of the frit (ingredients of the coating). Vital steps in preparation and application depend on closely controlled gas-fired ovens and furnaces. The raw materials are highly refractory, and fusing them into a basic frit requires furnaces capable of maintaining consistent temperatures up to 2500° F.

After the molten material has been quenched, ground, and mixed with water, a thin coat is sprayed on the part and it is placed in a semi-muffle oven furnace controlled by a pneumatic modulating recorder-controller. Depending on the ceramic formulation, the coating is fused to the part at a temperature between 1700° and 2000° F. The high firing temperature assures strong adherence so that the coating will resist the effects of distortion, vibration and abrasion. Also, the gas fuel affords the rapid recovery after charging, close temperature control and easy adjustment of furnace atmosphere needed during the complete cycle.

Solaramic processed nozzle boxes, used to conduct hot gas from reciprocating engines to superchargers, being withdrawn from the gas-fired furnace where the coating is baked on at temperatures above 1700° F.



Safety Regulation and Pressure Control



Safety regulation in low-pressure gas distribution systems has been one of the most discussed subjects in the gas industry for the past year. The Brighton accident and some others of a similar but less serious nature have made the entire industry aware of the hazards which are created when a low-pressure system is subjected to uncontrolled high pressure. Damage liability suits in these accidents, which have run from a few hundred thousand dollars to several million dollars, rather forcefully focus attention on this subject.

Since the subject is of such tremendous importance at this time, we believe that as much information as possible should be published on it. In the past we have covered the subject with the Bureau of Mines report on the Brighton incident (*GAS,* March 1952, p. 37), the article by Allen MacLean titled "Safety in the Regulation of Gas Pressures" (*GAS,* April 1952, p. 51), and the article "Safeguarding Low-Pressure Systems Against Excessive Pressure" by P. G. Havenstein (*GAS,* August 1952, p. 49).

This month we present, on the following pages two new studies of safety regulation and pressure control. There are differences of opinion of course in the two articles but this only reflects the general lack of agreement throughout the industry as to the "best" method of regulation. Actually, the most desirable safety system for any utility will depend largely on local conditions and will vary accordingly. But it should be mandatory for all operating men to give thorough consideration to all aspects of maintaining safety in order to add to their store of knowledge the facts which will enable them to devise the best possible system to fit their own conditions.

Safety Relief and Shut-Off Valves

...For Distribution Systems

By K. R. D. WOLFE
Fisher Governor Co.
Marshalltown, Iowa

MUCH of the recent attention to safety regulation was created as a result of a serious accident that occurred in one of the eastern gas company properties. This accident apparently resulted from a gas explosion in a regulator pit, which, in turn, caused the pressure regulators to fail in the open position and allowed intermediate pressure gas into the low pressure system. There were no service regulators on the customers' lines, and as the excessive pressure reached the low pressure meters, many of them bulged and ruptured, causing a series of fires and explosions in residences, resulting in fatalities and injuries and the destruction and damage of property.

Exclusive

The force of the explosion dislodged the gate valve box over the high pressure inlet valve at the regulator station; consequently, difficulty was experienced in shutting off the high pressure gas. Approximately 50 minutes was required to stop the flow of the high pressure into the low pressure system.

Unfortunately, there was no relief valve on the low pressure side of the regulator station to vent the excess gas in case of an accident of this kind, and the high pressure gas continued to flow into the low pressure system during this entire 50-minute period. The area being served was essentially a dead-end section, and, therefore, none of the excess gas could be absorbed in other mains, which might have given some relief, had this been an extensive, inter-connected system.

It should be stated that in referring to a low pressure system, we mean one operating at inches of water column or ounces, and that the intermediate pressure referred to can be from 1 lb up to pressures as high as 15 or 25 lbs.

Following these accidents, Fisher Governor Co. was called upon by many major gas utilities to assist them in developing special control valves of the shutoff and relief valve type, which would prevent such accidents on their systems in the future.

Three Safety Methods

There are three schools of thought within the industry as to the best method of protecting a low pressure system from excessive pressures in the case of a district regulator failure.

One school believes in relief valves to open and vent any excess gas in case of a district regulator failure.

The second school takes the position that they would prefer to shut the district regulator off completely, in case of a regulator failure, by means of an automatic safety shutoff valve. In this case, if the low pressure system is inter-connected with other district regulators, the area formerly supplied by the cut-off regulator will probably be accommodated by the other inter-connected regulators. If not, there will be a deficiency of gas in that immediate area only, which is deemed less hazardous than allowing high pressure into the section of the main valve.

The third group believes in what is

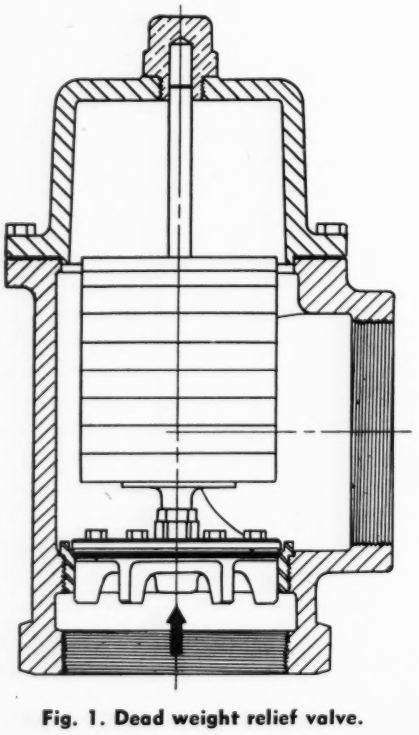


Fig. 1. Dead weight relief valve.

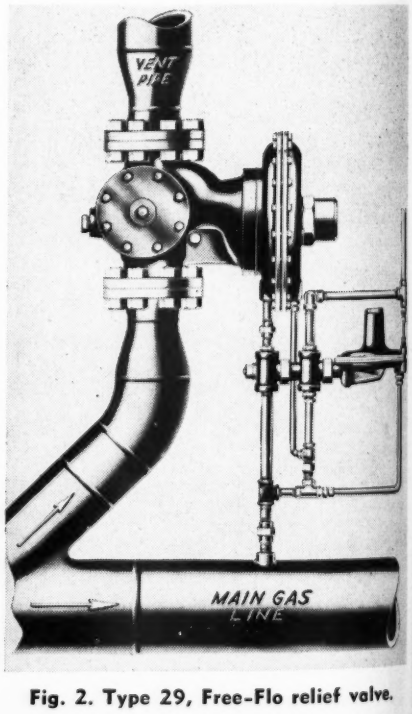


Fig. 2. Type 29, Free-Flo relief valve.

now commonly called "monitor regulators." In this case, in addition to the standard or normal district regulator, a second or stand-by regulator is installed, usually upstream of the normal regulator. The normal regulator does the usual job of regulation, and the secondary unit is set for a higher controlled pressure and will take over the control job, should the normal regulator fail to open.

In addition to these three basic plans, there are many combinations of these various ideas. The purpose of this article is to discuss and describe many of these special controls and new types of regulator installations, which will tend to eliminate this type of hazard in a low pressure gas distribution system. It is well, first, to discuss some of the safety devices and methods which have been in common use in the industry for many years past.

Everyone, of course, is familiar with the common dead weight safety relief valve. There are many types of this device, but essentially they all have similar characteristics. *Fig. 1* shows a typical valve of this design. In addition to the dead weight type relief valve, there are two similar devices using the same basic design. One is referred to as "spring loaded," the other "lever and weight loaded," but these two valves are generally used for higher relief pressures than are being considered here and, therefore, they will not be discussed further.

Dead Weight Relief Valve

The dead weight valve, as shown in *Fig. 1*, is not a very satisfactory relief valve for low pressure systems. It is generally conceded that a low pressure system should not be subjected to much over 1 psi and, therefore, relief valves on such a system must be capable of relieving all of the gas that could pass through a district regulator should it fail in the wide open position. The dead weight relief has only a limited operating force to open it. This force is the amount of pressure in psi times the effective area of the valve disc. For instance, in a 6-in. valve, the disc area is roughly 20 sq in. If the valve is set to relieve at 1 psi, the dead weight loading must equal 20 lbs force to keep the valve in the closed position up to that pressure value. It will be seen that it takes additional pressure to build up against this small effective area to open the valve to start exhausting gas in the case of an emergency. To open the port of a valve of this type wide open, the inner valve must lift one-fourth of the port diameter. It is almost impossible for a valve of this kind to do this because to do so would require too great a pressure build-up in the low pressure system.

A 6-in. dead weight relief valve of this type has an actual test capacity, with 1 psi blowing pressure, of approximately 30,000 cfh.

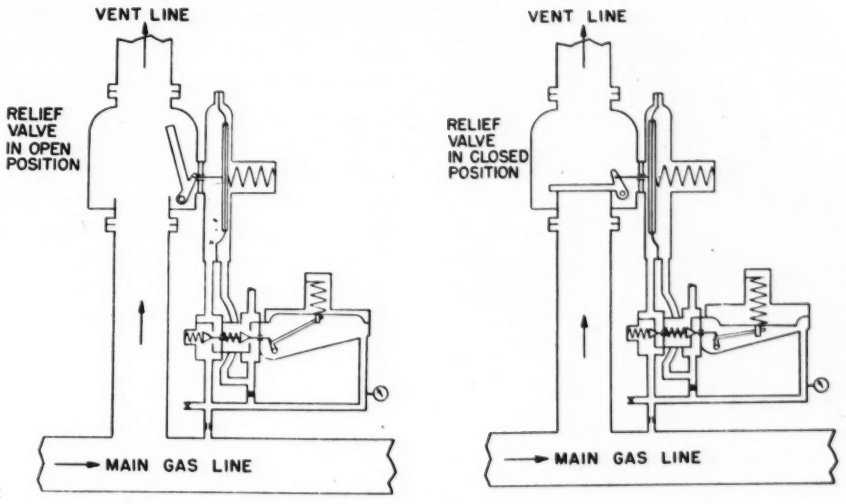


Fig. 3. The Type 29 valve installed in open and closed positions.

Capacity of District Regulators

Now compare this relief capacity of 30,000 cfh with the capacity of a district regulator should it fail in the open position. Assume the following conditions:

15 lbs inlet
7-in. wc outlet
Regulator sizes 2, 3, 4 and 6 in.

These regulators would have the following capacities in the wide open position, under these conditions:

Valve Size	*Regulator Wide Open Capacity*
2 in.	62,000 cfh
3 in.	85,000 cfh
4 in.	200,000 cfh
6 in.	350,000 cfh

With the 6-in. dead weight relief valve, having a capacity of only 30,000 to 40,000 cfh at 1 psi blowing pressure, it will be seen how inadequate such a valve is for this type of service, even with a 2-in. district regulator.

Liquid Seal Reliefs

The other relief device which has been popular is the so-called "oil seal." The oil seal or liquid seal relief has been made in many designs and shapes. The principal limitation of the oil seal is that, to prevent the loss of oil in case of blowing, it has been necessary to design the unit with a series of baffles or plates which causes change of flow direction of

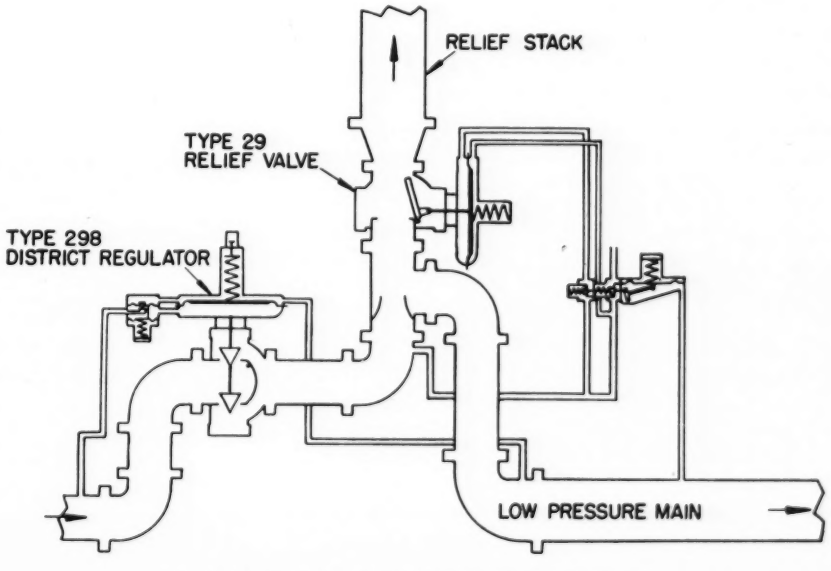


Fig. 4. Another installation of the Type 29 valve.

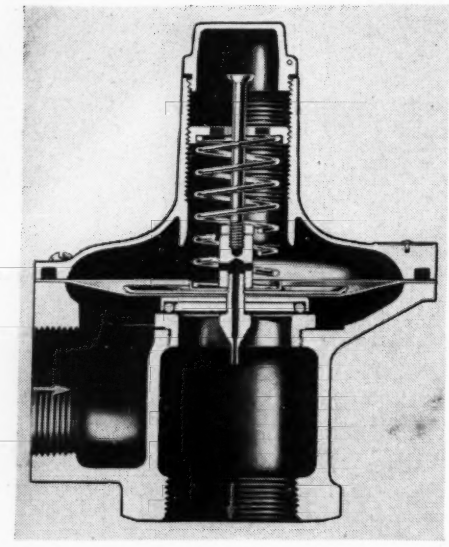


Fig. 5. Small relief valve of the self-contained type.

the gas. This, in turn, causes resistance to the gas flow, resulting in high pressure drops through the unit and, therefore, limited capacity. Furthermore, it is difficult in case of blowing of the oil seal to prevent all of the oil from being discharged out of the unit. Thus when the pressure in the line returns to normal the relief may still be open, causing great loss of gas and the possibility of exhausting all of the gas from the low pressure system.

New Relief Valve Developments

In response to this very exigent condition, Fisher Governor began a development program in cooperation with several major utility companies to produce a more satisfactory relief valve together with special monitor regulators and safety shutoff valves of various types.

The most outstanding of all of these developments is the new Type 29 Free-Flo relief valve shown in *Fig. 2*. The sectional schematic drawings in *Fig. 3* show this valve installed in the closed and open positions. The Type 29 has many advantages over the older methods of relief devices.

First, it has capacities greatly in excess of any current type relief valve or oil seal of like size.

Second, owing to its extreme sensitivity, it can be set to relieve at pressures only a few inches of water column over the normal operating pressure of the district regulator. Common practice is to set the relief valve at 15 to 20 in. wc, with the normal operating pressure 7 to 8-in. wc.

Third, the valve will open wide and close tight on a pressure change of from 2 to 4-in. wc.

Fourth, the valve will throttle in the partially open position and exhaust only the amount of gas which is in excess of the demand on the distribution system and will shut off as soon as the emergency is past and the pressure returns to normal.

Fifth, the valve will shut off absolutely tight while pressures are normal or until there is a demand for the valve to open.

Sixth, the valve is of heavy, rugged construction and of simple design. A large area operating diaphragm and simple switch-over relay create positive operating force to eliminate sticking or mal-function.

Seventh, the unit can be periodically tested simply and quickly.

Eighth, the valve body is equipped with a large hand hole plate for easy inspection or replacement of internal parts.

Ninth, the entire relief valve is completely water-tight, requiring only one vent line. Therefore, it can be operated in pits regardless of whether they are subject to flooding or dry conditions.

Tenth, the special design Free-Flo "L" body permits inner valve to be opened completely out of flow stream allowing gas flow straight through body. Thus, the pressure drop, even on maximum flows, is negligible.

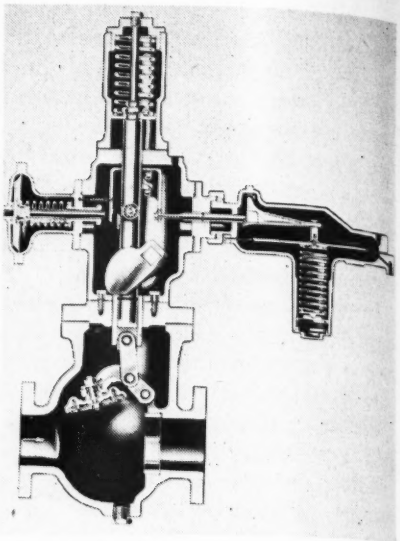


Fig. 7. Safety cut-off regulator.

The method of installing the Type 29 is extremely important and greatly affects its capacity. Exhaustive field tests with different hook-ups have been conducted to determine methods which would develop the greatest capacity through the relief valve. *Fig. 2, Fig. 3,* and *Fig. 4* show three different methods of making the Type 29 installation. To show the importance of these different installations, the following capacities for the same pressure conditions are given:

A 4-in. Type 29 was tested on each type of installation, with the main line an 8-in. size and the control line tapped into the main line 8 ft away from the relief valve. The valve was set to open and relieve at 1 psi in the main line.

The approximate capacities for the three installations for these three conditions are as follows:

	Capacity of 4-in. Valve
Fig. 3	86,000 cfh
Fig. 2	122,000 cfh
Fig. 4	169,000 cfh

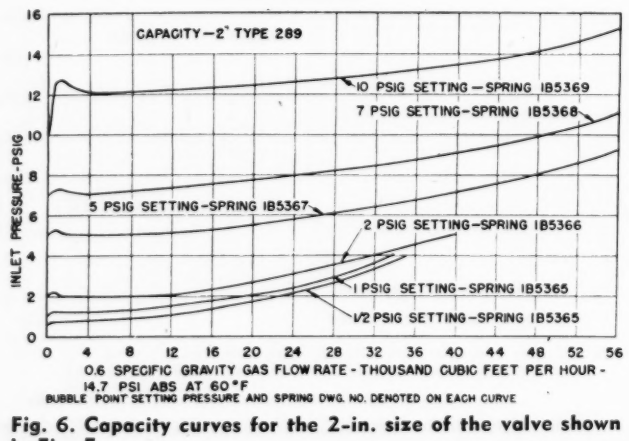

CAPACITY—2" TYPE 289
10 PSIG SETTING—SPRING 1B5369
7 PSIG SETTING—SPRING 1B5368
5 PSIG SETTING—SPRING 1B5367
2 PSIG SETTING—SPRING 1B5366
1 PSIG SETTING—SPRING 1B5365
1/2 PSIG SETTING—SPRING 1B5365
INLET PRESSURE-PSIG
0 2 4 6 8 10 12 14 16
0 4 8 12 16 20 24 28 32 36 40 44 48 52 56
0.6 SPECIFIC GRAVITY GAS FLOW RATE - THOUSAND CUBIC FEET PER HOUR -
14.7 PSI ABS AT 60°F
BUBBLE POINT SETTING PRESSURE AND SPRING DWG. NO. DENOTED ON EACH CURVE

Fig. 6. Capacity curves for the 2-in. size of the valve shown in Fig. 5.

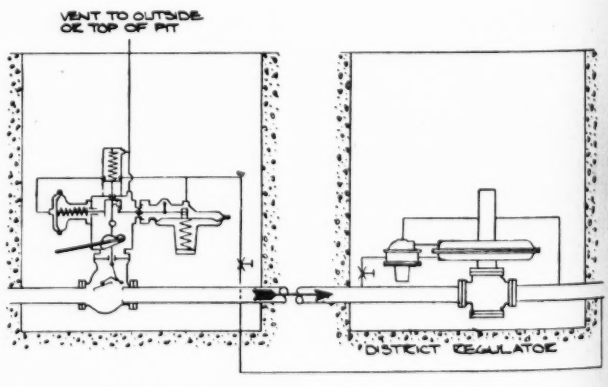


Fig. 8. Type and method of installation of the safety cut-off regulator.

In the case of the installation *Fig. 4*, the relief valve capacity is influenced by the inlet pressure ahead of the district regulator, owing to the venturi throat action installed ahead of the relief valve inlet. This venturi changes static head into velocity head without increasing the main line downstream pressure and, with this increased velocity head, the relief valve has greatly increased capacity.

The capacities for the 4-in. relief valve with various inlet pressures at the district regulator inlet produced the following flows:

Pressures at Regulator Inlet	*4-in. Relief Valve Capacity*
10 psi	169,000 cfh
20 psi	241,000 cfh
30 psi	315,000 cfh
40 psi	400,000 cfh

The above relief capacities are while maintaining 1 psi in the low pressure distribution line. It should be clear that these greatly increased capacities are obtained due to the special venturi fitting at the relief valve inlet. The above figures are for 4-in. size only. Capacities for the 6- and 8-in. sizes will, of course, be proportionately greater.

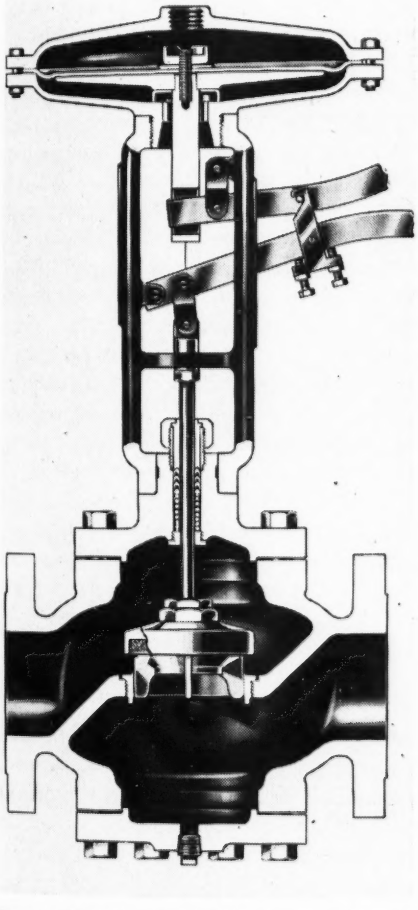


Fig. 9. Cut-off valve which closes only with a loss of pressure on the diaphragm.

The approximate capacities of these two sizes for 1 psi relief pressure, installed as per *Fig. 2*, are as follows:

6-in. size	280,000 cfh
8-in. size	470,000 cfh,

and, by using the venturi type installation, much greater capacities can be obtained. With 10 psi inlet pressure on the district regulator, these capacities would be increased by at least 30%, because of the use of the venturi installation.

From the above figures it will be readily seen that for the first time the gas industry is offered a safety relief valve which will adequately meet the requirements for low pressure gas distribution systems.

Piping

As has been pointed out earlier in this article, it is extremely important that the piping to the inlet of the relief valve, as well as the piping from the outlet of the relief valve, when operating on these low pressures, be designed in the best possible manner. The piping should be of the absolute minimum length, it should be of the greatest possible size, and if at all possible, all elbows, tees and right angle changes of flow direction should be eliminated.

It is advisable, when installing a relief valve of, say the 6-in. size, to use the next larger pipe size for both the inlet and outlet piping. It would be recommended that with 4-in. relief valves, 6-in. piping be used; with 6-in. relief valves, 8-in. piping be used.

As an example, let us assume that you want to keep pressure at 1 psi or below in a low pressure distribution line handling a maximum of 250,000 cfh. You would install this using a 6-in. tee and, off the branch of the tee, install 2 ft of 6-in. pipe, and then the "L" body relief valve and 12 ft of 6-in. straight vent pipe.

The branch off the tee equals the equivalent of 34 lineal feet of pipe of the same size. The 2 ft of pipe, of course, is equal to only 2 ft of pipe, the "L" body is equal to 11 ft of pipe, and the 12 ft equals 12 ft of pipe. This makes a total of 59 ft of 6-in. pipe through which the gas must flow and the pressure drop must be accounted for. Now, if you were attempting to pass 250,000 ft per hour and maintain the pressure in the line not to exceed 1 psi, you would find this impossible to do because the pressure drop through 59 ft of 6-in. pipe with this flow is equal to 30.3-in. wc loss. In other words, the lowest pressure that you could maintain in the way of a relief valve with this set-up would be 30.3-in. wc or somewhat over 1 psi.

Small Relief Valves

In addition to the Type 29, Fisher also has produced a new series of small relief valves of the self-contained type for low pressure relief service, the Type 289, which will be made available in sizes 1 in. and 2 in. as illustrated in *Fig. 5*. This shows the relief valve in sectional view, and *Fig. 6* shows a set of capacity curves for the 2-in. size. These relief valves are available for relief pressures from ½ psi to 10 psi setting.

From the *Fig. 6* it will be seen that with the 2-in. relief valve set for 1 psi opening pressure and with a build-up of ½ psi, blowing, therefore, at 1½ psi it is discharging 10,000 cfh and with a blowing pressure of 2 psi, 15,800 cfh. Capacity data for the size 1 in. are not available at this time.

It is intended that these smaller relief valves will provide for the industry satisfactory low pressure relief valves in conjunction with smaller or commercial or

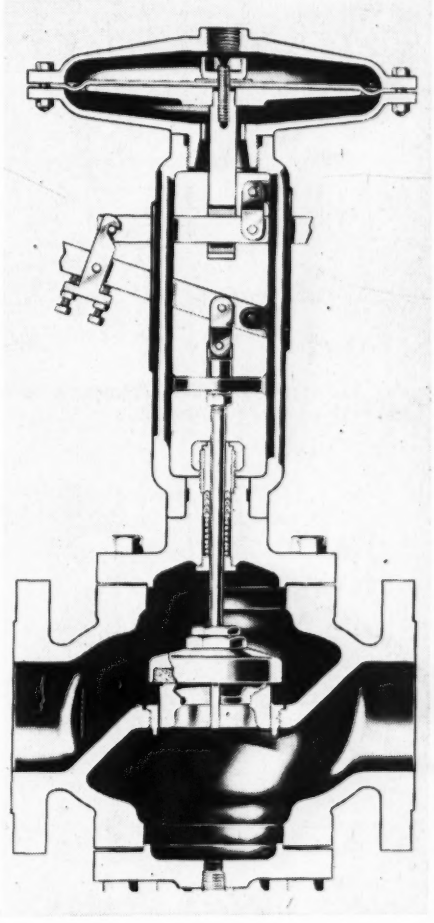


Fig. 10. Cut-off valve which closes only with an increase of pressure on the diaphragm.

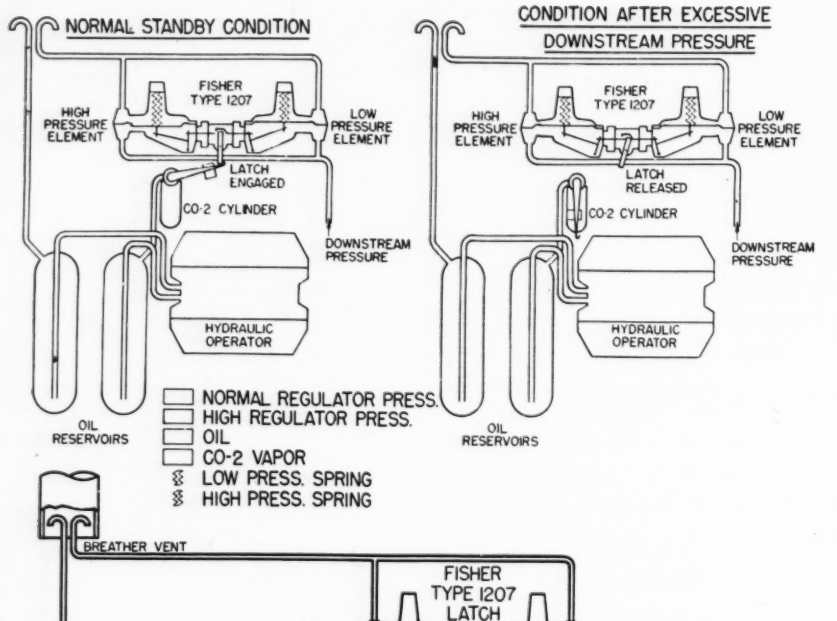


Fig. 11. A special double diaphragm latch mechanism which protects against either too high or too low pressure.

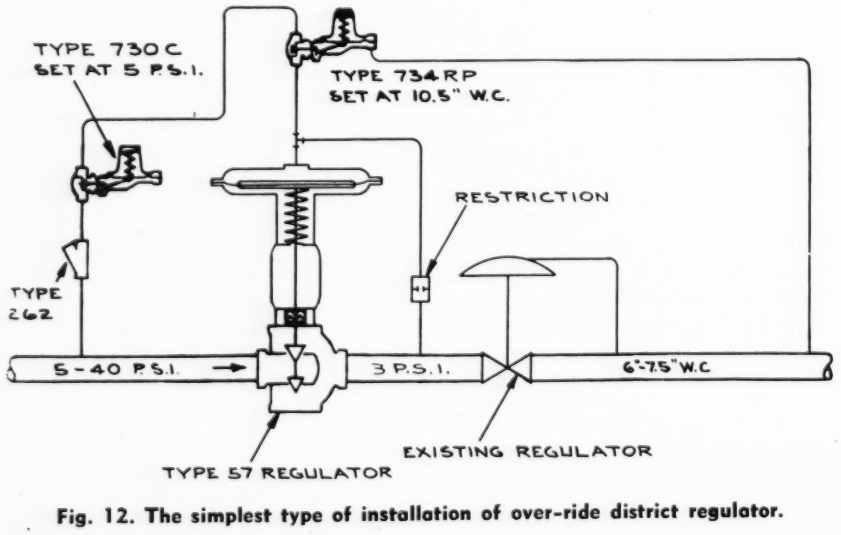


Fig. 12. The simplest type of installation of over-ride district regulator.

industrial type installations where heretofore there has been no satisfactory low pressure safety device suitable for this type of application.

Safety Shutoff Valves

Many gas engineers do not want to use relief valves on the low pressure distribution system because of the potential hazard of venting large volumes of gas into congested areas. Instead, they prefer to use shutoff valves and shut a regulator station off completely in case of an emergency such as a regulator failure. In this type of application it is generally assumed that if a district regulator does fail and is shut off, the area being supplied by this regulator can be taken over in the emergency and supplied by other inter-connected regulators.

Fig. 7 shows the new Type 1275-L safety cut-off regulator which has been developed especially for this type of service. *Fig. 8* illustrates the method and recommended type of installation.

The Type 1275-L is designed to go in the closed position in case the downstream pressure of the district regulator should go above or below a given setting. The values at which the shutoff valve cuts out can be adjusted, but it is customary to set the low pressure cut-out point at 2 in. wc for a minimum pressure and 1 psi for the high pressure cut-off.

The shutoff valves should be installed as shown in *Fig. 8*, in a separate pit or house on the high pressure line some distance upstream of the normal district regulator. This shutoff valve has been designed with a special body which permits the inner valve to be traveled completely open out of the flow stream and the gas can pass through the body in a straight flow manner. Thus the pressure drop through the body is negligible.

The valve is manually opened by means of a reset lever and a rotary stem through the water tight topwork case and is held in the open position by means of a positive trigger mechanism.

Should the controlled low pressure go above or below the set limits of the shutoff valve, the trigger is released and a powerful spring causes the valve to go in a tight closed position. An additional safety feature is built into this valve to prevent the premature opening of the valve after an emergency has caused it to close. This feature prevents the valve from being manually opened until the downstream or controlled pressure has been re-established to the operating value.

The Type 1275-L is available in sizes

of 4, 6, 8, 10, and 12 in. and can be supplied for various pressure conditions.

Also available are cut-off valves which operate only on pressure failure or pressure increase. The Type 10K, which is shown in *Fig. 9*, closes only with a loss of pressure on the diaphragm. The Type 10-L, *Fig. 10*, closes only with an increase of pressure on the diaphragm. Both valves must be manually reset after they have tripped in the closed position. These valves are positive and accurate in their operation, and can be supplied for various cut-out pressures from inches of water column up to 100 lbs.

Many district regulators which were installed in pits several years ago have such limited space within the pit that it is almost impossible to add new shutoff equipment and, in many cases, it is virtually impossible to secure additional property for the location of new pits for such installations.

For such types of installations, equipment is now available for attachment to plug cocks which are generally installed upstream and downstream from the district regulator by means of which the plug cock can be operated and turned into the closed position should an emergency pressure condition occur, owing to a district regulator failure.

Fig. 11 shows a special double diaphragm latch mechanism which, in case of an increased pressure or a decreased pressure, causes a trigger mechanism to be disconnected, puncturing a CO_2 cylinder, which in turn supplies a high hydraulic force for turning the plug cock shutoff mechanism. This assembly is comparatively compact in size and is positive in its operation to protect the low pressure distribution system from either excess pressure or too low a pressure. It, of course, has the disadvantage of depending upon old plug cocks now in the system to operate properly with this type of mechanism during an emergency.

The diaphragm assemblies are available for operating at various pressures on the cut-out value of 2 in. wc up to 50 or 75 psi. This series of latch mechanism assemblies is known as Type 1207.

Over-Ride District Regulator

Protecting low pressure distribution systems from over-pressure caused by district regulator failures can be accomplished in still another manner in addition to the two methods we have previously discussed. This additional plan of protection involves the use of what has commonly become known as a "monitor" or "over-riding regulator." *Fig. 12* shows a drawing installation of probably the simplest type of this kind of an installation.

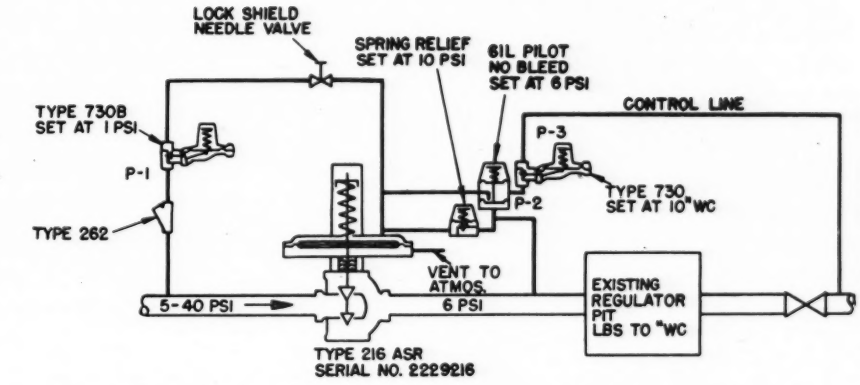


Fig. 13. Another type of installation of over-ride district regulator.

It will be noted that the existing regulator is reducing from psi to in. of wc and the delivery pressure in the low pressure system is running from 6 to 7½ in. wc. The over-riding regulator in this case is a direct-operated Type 57 spring-actuated-diaphragm control valve. From the diaphragm there is a control pipe leading to the downstream side of this regulator and in the control pipe a fixed restriction, say a ⅛-in. orifice. The normal purpose of the Type 57 regulator under normal operation is to reduce the high inlet pressure, which may be as high as 40 psi on this job, down to a constant value of 3 psi to the inlet side of the existing district regulator.

Should the existing regulator fail in the open position, the low pressure system pressure would tend to increase. As the downstream pressure reached a value of 10.5 in. wc, the Type 734RP over-riding pilot would open, allowing the 5 psi from the 730C regulator now to be partially exposed to the main diaphragm of the Type 57 regulator. This in turn, now tends to make the Type 57 regulator operate as a district regulator, maintaining a delivery pressure into the low pressure system of 10.5 in. wc. Thus it acts as a safety regulator, preventing extremely high pressures in the low pressure system in an over-riding manner.

There are a great many different methods of installing regulators of this type. *Fig. 13* shows a different idea, but along a similar manner. The operation of the over-riding regulator in *Fig. 13* varies from the regulator just discussed in that the pilot valve P-2 operates the main valve, Type 216, normally supplying 6 psi to the inlet of the existing regulator. The supply regulator P-1, Type 730C, is constantly operating, supplying 1 psi operating pressure to the main regulator diaphragm. If the existing regulator should fail in its operation and go wide open, the downstream pressure which is normally 7 in. wc, would approach the 10 in. wc setting of regulator P-3, caus-

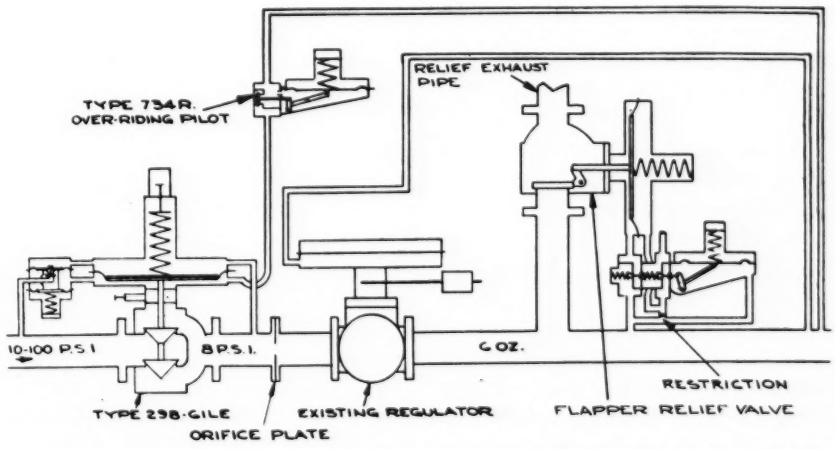

RELIEF EXHAUST PIPE
TYPE 734R OVER-RIDING PILOT
10-100 P.S.I.
8 P.S.I.
6 OZ.
RESTRICTION
TYPE 298-GILE
EXISTING REGULATOR
FLAPPER RELIEF VALVE
ORIFICE PLATE
ORIFICE PLATE SIZED TO RESTRICT FLOW TO RELIEF CAPACITY WITH 1 P.S.I. DOWNSTREAM PRESSURE. OVER-RIDING PILOT SET AT 8 OZ. TO MAKE TYPE 298 CONTROL DOWNSTREAM PRESSURE AT 8 OZ. IF EXISTING REGULATOR FAILS. RELIEF PILOT SET FOR 1 P.S.I.

Fig. 14. A combination of the over-riding regulator and the existing regulator.

ing that regulator to go in the closed position and thus build up pressure on the loading side of the main diaphragm of the over-riding regulator. This then, places the over-riding regulator in a position to reduce from pounds to 10 in. wc. The spring relief valve shown in the pilot system is merely an emergency unit to add additional pressure to the main diaphragm, should that regulator not shut off properly during low load conditions.

Fig. 14 shows a combination idea of the monitor regulator or over-riding regulator. In this case, the over-riding regulator is normally operating reducing the high inlet pressure to an arbitrary medium pressure value of, say, 8 to 10 psi. A Type 734 over-riding pilot is normally in the closed position, and the existing regulator is delivering 6 ounces to the downstream low pressure system. Should the existing regulator fail in the open position and the downstream pressure build up to 7 ounces, the over-riding pilot, Type 734R, would open, making the Type 298-61LE regulator now control the main line low pressure at 7 ounces. If some further emergency should occur and both of the operating regulators should fail in the open position and the main reduced pressure system tend to go above 1 psi, then the Type 29 relief valve in the low pressure system would open at 1 psi, venting all of the gas coming through the failed regulators.

As stated previously, there are a great many variations of these types of regulator hook-ups but we believe that a sufficient number of them have been shown and their operations cited to give adequate information pertaining to these types of safety controls.

In conclusion, I would urge all engineers interested in the distribution of low pressure gas on public utility distribution systems to give extreme care and thorough consideration to all of the aspects of maintaining safety in their particular system. I do not advocate, particularly, any one safety system over the other. It will depend greatly upon the local conditions as to which system of safety is most desirable to use.

I do believe, however, that whenever possible, the normal district regulator should be operated in conjunction with a monitor or over-riding regulator and as a secondary precaution, a downstream low-pressure safety relief valve of adequate capacity and sensitivity should be installed for complete protection against excessive pressures in the low pressure system.

Gas Pressure Regulation And Safety Control

By HOWARD EVANS
Rockwell Manufacturing Co.
Pittsburgh, Pa.

AS we all know, in the natural gas industry safe pressure control is essential from the time the gas is produced at the well until it has been transported and finally delivered to the customer. Gas pressures may range from 3000 psi down to zero and in most cases these pressures must be controlled between very critical limits to accomplish the desired results in a safe manner. The type of regulator to be used on any particular job should be carefully considered from a safety standpoint, as well as from the standpoint of its ability to handle the pressure and volume.

Exclusive

Structural Design

Careful consideration is given to the structural design of gas pressure regulators, as they must not only withstand all internal pressures but also external stresses and possible exposure to sudden shock loads. However, even with all the care taken on a regulator design there is always some possibility of failure in some of the moving parts. Past experience usually enables us to predict any mechanical regulator failure which may occur. Every particular installation should be carefully analyzed and the type of regulator specifically chosen which will not result in damage to property should failure occur. The ideal safety control type of regulator should not only insure safe gas pressure but also, in case of an initial mechanical failure, give some indication of this failure so that corrective measures can be taken. For example, if a regulator fails closed and a standby regulator takes over the load, the pressure gauge would record a change in pressure indicating that the secondary regulator had gone into operation.

Low Pressure Distribution Regulators

Regulators feeding gas from the intermediate pressure line to a low pressure distribution system should be given the most careful consideration from a safety standpoint. It is very important that the distribution pressure be held below a dangerously high pressure but is almost equally important that sufficient pressure be maintained so that service does not have to be discontinued. Regulators should not be oversized and low inlet pressures to the regulators are an advantage from a safety standpoint. A large distribution system with interconnected lines which is fed by a large number of regulators is definitely safer than a small system because a single regulator failure would then not be likely to cause either an over or under pressure condition.

Relief valves or liquid seals are generally used and located fairly close to the regulators. These relief valves should have sufficient capacity to handle the excess gas which could be fed through a regulator which failed to shut off properly. A back pressure regulator can be used as a mechanical relief valve and is particularly desirable when it is necessary to start relieving the gas with only a slight increase of pressure and still not have any leakage during normal operation *(Fig. 1)*. It is not feasible in most

The following article by Howard Evans is being run in two sections. The first section (below) is concerned with low pressure distribution regulators and house service regulators. The second section, dealing with pipeline and town border regulators, will be found in the Pipeline Section.

cases to install enough relief capacity to handle a complete regulator failure in which the valves fall wide open and such a large relief volume would in turn be a definite hazard in many locations.

Probably the best method of insuring against overpressure is to use two regulators connected in series. Both regulators have their control lines connected into the main outlet line but one regulator is set at a slightly higher pressure so that it remains in the open position. Any rise in outlet pressure will cause the standby regulator to come into operation and control the pressure at a slightly higher volume. *Fig. 2* shows a typical regulator installation using Rockwell low pressure balanced valve regulators. The first regulator is normally wide open and has a special lubricating stuffing box between the main diaphragm and the body of the regulator. The second regulator is set for the desired outlet pressure.

Since it is usually desirable that regulators feeding low pressure systems should fail in a closed valve position, the low pressure balanced valve regulators equipped with power pilots have a definite advantage. Any failure due to stoppage of the pilot regulator or diaphragm rupture would cause the main valves to close *(Fig. 3)*.

Varying Pressure

While some companies use a varying inlet pressure depending on the load to restrict the regulator capacity, other companies use an orifice ahead of the

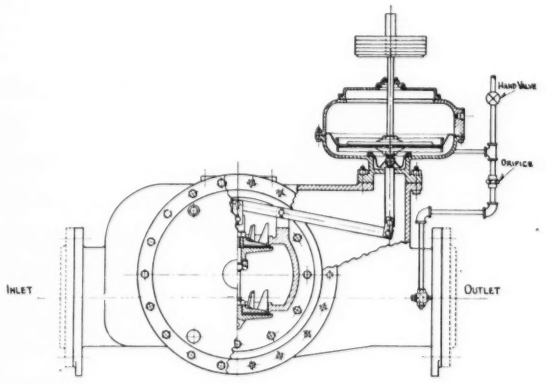


Fig. 1. Low-pressure balanced-valve regulator used as cutoff.

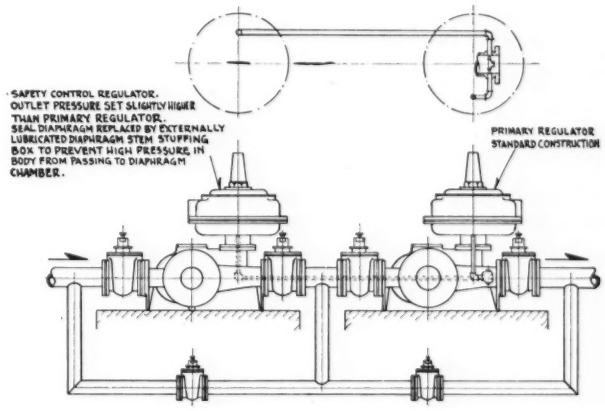

SAFETY CONTROL REGULATOR. OUTLET PRESSURE SET SLIGHTLY HIGHER THAN PRIMARY REGULATOR. SEAL DIAPHRAGM REPLACED BY EXTERNALLY LUBRICATED DIAPHRAGM STEM STUFFING BOX TO PREVENT HIGH PRESSURE IN BODY FROM PASSING TO DIAPHRAGM CHAMBER.
PRIMARY REGULATOR STANDARD CONSTRUCTION

Fig. 2. Low-pressure balanced-valve regulators in series installation.

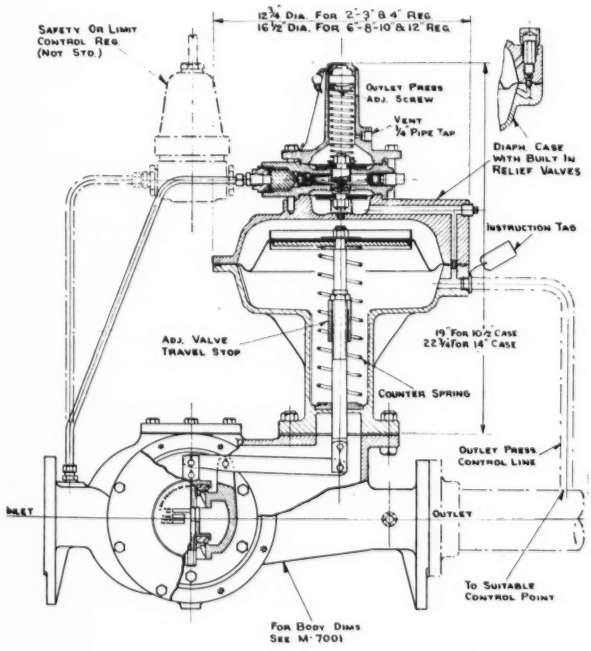

SAFETY OR LIMIT CONTROL REG. (NOT STD.)
12¾" DIA. FOR 2"-3"-4" REG.
16½" DIA. FOR 6"-8"-10" & 12" REG.
OUTLET PRESS ADJ. SCREW
VENT ¼" PIPE TAP
DIAPH. CASE WITH BUILT IN RELIEF VALVES
INSTRUCTION TAG
ADJ. VALVE TRAVEL STOP
19" FOR 10½" CASE
22¾" FOR 14" CASE
COUNTER SPRING
OUTLET PRESS CONTROL LINE
INLET
OUTLET
TO SUITABLE CONTROL POINT
FOR BODY DIMS SEE M-7001

Fig. 3. Low-pressure balanced-valve regulator with pilot loading.

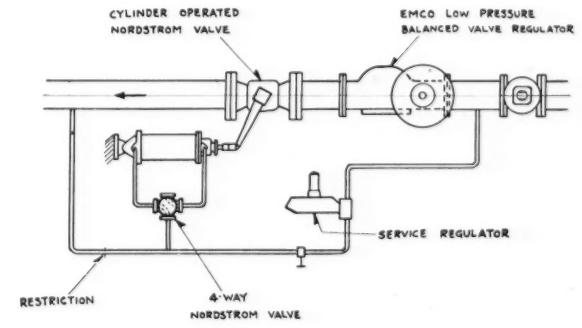


Fig. 4. Safety shutoff valve to prevent over pressure.

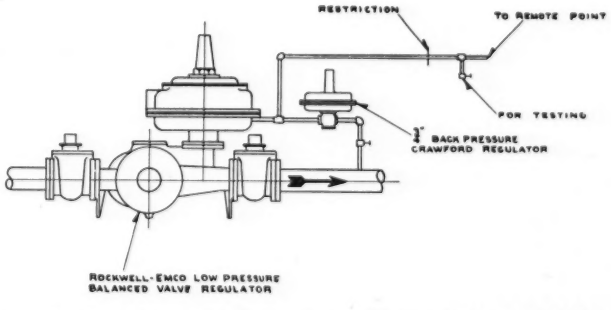


Fig. 5. Remote control line with auxiliary safety control line.

regulators which is so sized as to allow normal operation but which would definitely limit the capacity in case of a complete failure. Such a limiting device is not entirely satisfactory since the limiting capacity must be quite high and therefore it would be of less value if the failure occurred during an off-peak load.

Ideal System

A combination of the use of relief valves and limiting the gas input from the regulators is the ideal safety control system. In the regulators mentioned above, the chance of overpressuring has been minimized, particularly when using regulators in series. Also, with most of the types discussed, there is very little chance of completely losing pressure on the system.

An additional safety measure can be added by arranging for the closing of the Nordstrom valve on the inlet side of the regulator by means of a pressure cylinder. This system should be set to operate only when the pressures in the distribution line are approaching a hazardous condition. *Fig. 4* shows a schematic piping arrangement for such a control.

In many low pressure regulator settings it is desirable to convert the diaphragm control point or impulse line at a downstream point outside the regulator vault. This type of control line will result in a more constant pressure in the system since it eliminates the effect of the pressure drop in the pipe fittings and valves usually installed directly at the outlet of the regulator. However, there is always some possibility that such control lines may become broken which would cause the main regulator to open up wide. This can be overcome by using a restriction in the remote control line and having a second control line connected directly at the regulator outlet which is normally kept closed by a back pressure regulator. In case the remote lines become broken, the second control line will open when the pressure starts rising and keep the regulator from going wide open. See *Fig. 5*.

House Service Regulators

Gas utilities are using intermediate pressure distribution lines more and more. In this type of system, service regulators are used for each individual customer. The Rockwell service regulator can be furnished with either an internal relief valve, dead weight safety valve, or a mercury seal to relieve high pressure on the outlet side of the regulator which might occur through foreign material lodging on the valve disc or a similar accident.

The internal relief valve design uses the power available from the large diaphragm to open the relief valve. There is only one vent line necessary with this type of regulator. Any change in the outlet pressure setting also increases the pressure at which the relief valve will open. Normally, the pressure will be relieved at approximately 10 inches of water above the regulator setting *(Fig. 6)*.

The dead weight relief valve can be weighted for the desired relief pressure. The lubricated valve eliminates the possibility of the valve sticking to the seat *(Fig. 7)*.

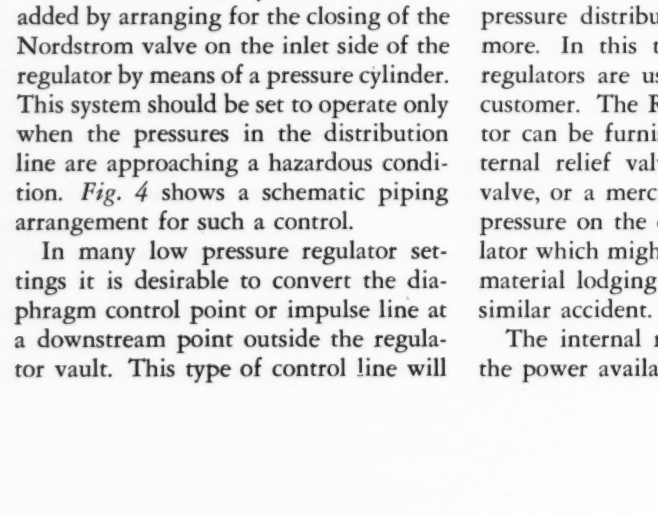
Maintenance

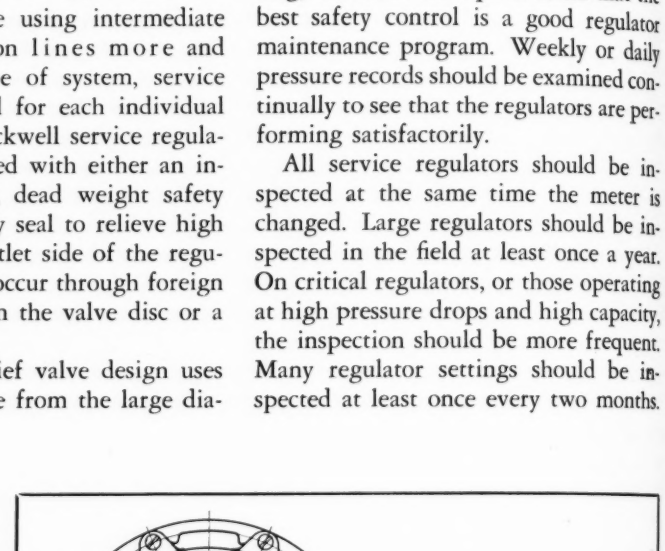
After careful consideration has been given to each individual regulator setting, it should be kept in mind that the best safety control is a good regulator maintenance program. Weekly or daily pressure records should be examined continually to see that the regulators are performing satisfactorily.

All service regulators should be inspected at the same time the meter is changed. Large regulators should be inspected in the field at least once a year. On critical regulators, or those operating at high pressure drops and high capacity, the inspection should be more frequent. Many regulator settings should be inspected at least once every two months.

Fig. 6. (Below) Emco ejector service regulator, spring type with internal relief valve.

Fig. 7. (Right) Service regulator with dead-weight safety valve.





What to Look for in Gas Rates and Rate Structure

By WALTER J. HERRMAN
Southern California Gas Co.
Los Angeles

IN an unregulated business, prices are a means to an end—several ends. Basically, they are the ingredient of revenues which cover the costs of the business and its profit. But careful attention to pricing may also be a major factor in the amount of that profit. This is especially true in a business which produces and sells a variety of products. In such cases, the price of one item may be fixed deliberately low for the purpose of promoting sales of other items with a large unit profit. In other cases, prices are varied during the different seasons of the year—reduced in summer to stimulate normally slow sales in that period, and increased around the holidays when business is normally good.

Although the opportunities may sometimes be restricted by regulation, prices can also be utilized to influence profits in the utility field. At the least, utility management should know what to aim for in prices, and the various rate schedules should, wherever possible, be designed to maintain and encourage the more profitable classes of business and to obtain the maximum utilization of the company's investment in service facilities. Flexibility of the schedules is desirable, and within reasonable limits, the design and level of individual rates should be principally a responsibility of management, subject, of course, to the approval of the public service commission. Only in this way can a utility initiate necessary experiments and make the timely changes in rates dictated by the practical needs of changing economic conditions. Given such freedom of initiative, what general principles are to be looked for in the design of gas rates?

Frank Newton of Commonwealth & Southern Corp., considered an outstanding authority in his time, laid down three fundamentals of sound rate design in an articles in *Public Utilities Fortnightly* in 1929. They were:

1. Over-all adequacy—Total revenues should cover total costs, including depreciation and a fair rate of return on the investment.
2. Class adequacy—The revenues from the major different classes of service should be reasonably related to the costs of supplying each class.
3. Competitive adequacy—Based on the value of the service to the customer, the rate should be designed to promote and hold the business.

While Mr. Newton's fundamentals may appear obvious and elementary, one should not jump to the conclusion that they are easily effectuated, especially if the rates are to be kept simple in form and easy to administer. Yet if all three are not reasonably fulfilled, the utility invariably finds itself in trouble over the long term.

There is considerable difference of opinion as to what constitutes over-all adequacy of income. A yardstick that we have used in Southern California Gas Co. rate cases has been the earnings of other gas distribution companies on their capital investment. One of our most recent studies covered substantially all the major natural gas distribution utilities in the country with assets over $20 million. The analysis showed that the earnings on the total capital investment for this group averaged about 8% annually during the last three years. The return on a depreciated original cost rate base would ordinarily be somewhat less, perhaps from 7% to 7½%, since most rate base figures also reflect that portion of plant financed with internal funds such as insurance and contingency reserves. While such earnings may seem strangely high to some of us, they are, nevertheless, factual and they provide a practical evaluation of over-all adequacy as measured by actual experience. Yet, in spite of this seemingly satisfactory average rate of return, nearly one-half of all these companies have either applied for or received increased rates during the last year. I conclude, therefore, if a given natural gas distribution company is to keep up with the industry of which it is a part, an over-all rate of earnings of at least 8% on its total capital investment is now required.

The committee on economics of the American Gas Assn. has been studying the changing risks of the gas business and the expected effect on the return requirements over the near term future. Its conclusion is that the risks and the earnings requirements are increasing. Inflation, of course, is still the principal villain. It is doubtful, for example, if even an 8% return on invested capital

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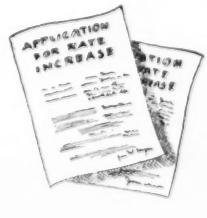
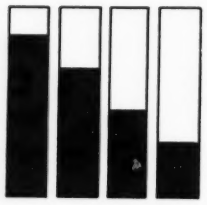


This paper was presented at the annual convention of the PCGA in Los Angeles on Sept. 3-5.

"A particularly disturbing increase in the risk factor has been the long-continuing decline in the margin of revenue carried through to net income. Those of you who have followed the financial statistics of utilities know that this ratio has been decreasing steadily for many years. This means that any change in operating expenses, as for example an increase in the cost of gas, is carried through to net income in proportionately larger degree than ever before and earnings are therefore becoming subject to increasingly extreme fluctuations more characteristic of a speculative enterprise than a public utility."



is adequate to keep pace fully with the dilution in earnings that results from high-cost plant additions and replacements, and from original cost depreciation accounting. Thus unregulated industry, with little or no debt and higher depreciation rates, seems to earn 15% or 16%, although it is doubtful whether an established business like General Electric or DuPont is not just as good an investment risk as a natural gas company dealing in a wasting natural resource, with earnings limited by regulation in good times, but in no way guaranteed if times get tough.

A particularly disturbing increase in the risk factor has been the long-continuing decline in the margin of revenue carried through to net income. Those of you who have followed the financial statistics of utilities know that this ratio has been decreasing steadily for many years. This means that any change in operating expenses, as for example an increase in the cost of gas, is carried through to net income in proportionately larger degree than ever before and earnings are therefore becoming subject to increasingly extreme fluctuations more characteristic of a speculative enterprise than a public utility.

Serious Risk

Another potentially serious risk has been developing out of the increase in gas purchases from pipelines under long-term take or pay contracts. During periods of improving demand, these contracts are generally regarded favorably, but looking forward to the time when prices may once again be declining, it is obvious that such contracts might boomerang on the distribution companies if the cost of competitive fuels should drop below the equivalent cost of gas. Likewise, if less distant and less costly gas supplies were discovered, it is obvious that the retail companies could not hold their markets at higher prices based on long-term contracts with the pipeline companies.

Still another problem arises out of rate increases by the pipeline companies under existing procedures of the Federal Power Commission whereby proposed increases are collected under bond and subject to refund. As an illustration, the three California companies which purchase from El Paso Natural Gas Co. face an annual increase of approximately $13 million beginning next Jan. 1. These companies have been working on a plan which it is hoped may enable them to put into effect offsetting retail rate increases, also subject to refund. If a successful program can be developed, this particular risk would be eliminated for these companies—at least for this occasion.

Gas Supplies

Another risk which increases with the passage of time is the end life of all the natural gas supplies. A few years ago, we in California had adequate supplies of local natural gas, but currently approximately half of our supply comes from out of state. The resulting problems are both technological and financial since it is necessary that the companies be in an especially sound financial position when they are required to make large expenditures for the development of new gas sources that will undoubtedly be required 25 or 30 years from now. Incidentally, security buyers are not unaware of these problems and underwriters now insist on much heavier sinking funds in natural gas company bonds than were required just two or three years ago.

The competition from electric companies for our high load factor cooking and water heating business is becoming more and more vigorous and this competitive situation undoubtedly will increase when the electric companies build up a larger margin of generating capacity.

I could disturb your peace of mind further with additional forecasts of a similar pessimistic nature, but the ones mentioned are sufficient to make the point that the degree of risk in our business seems to be increasing. The conclusion, in any event, is that adequacy of over-all return is more important today than ever before. Presumably, if a given company is unable to earn a fair return today when business generally is so prosperous, it may be in for really hard going when, as, and if business conditions are less favorable, and some or all of these potential problems become realities.

Service Costs

Mr. Newton's second requirement was that rates should be designed so as to produce revenues from each class of customer reasonably related to the cost of supplying the service. Actually, it is impossible in practice to allocate costs exactly and we know also that if we could make such exact allocations we would still not be able to reflect them precisely in our rate schedules.

This does not mean, however, that such cost indications as we do have should not be used as a management guide to rate design, in order to more nearly correlate revenues and costs, and at the same time improve the system load factor. A good load factor, of course, is very important in any utility operation where the amount of plant investment is so large in relation to revenues. This is especially the case in the gas utility where the seasonal space heating demand tends to produce an unusually low utilization of facilities.

Let us take a quick look at the major classes of service furnished by a typical natural gas company and compare the indicated costs and prices for each.

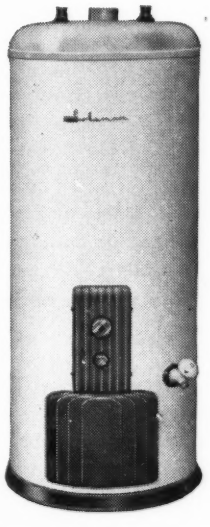
First and most important is the residential class which consists principally of cooking, water heating, some refrigeration, and a large amount of space heating. The first three of these uses, together with the consumption contributed by some of the newer appliances such as clothes dryers, represent year-round demands with a relatively good load factor and a correspondingly low average cost. Seasonal space heating, on the other hand, has a very poor load factor and a correspondingly high average cost. If we were to separate out the indicated costs for a typical California gas utility, they might run somewhat as follows:

1. Fixed customer costs which are independent of the use of gas—$30 per year per customer.
2. Base load cost for year-round cooking, water heating, refrigeration, etc.—30 cents per Mcf of gas used.

COMFORT! AUTOMATIC SAFETY!

HEATING EQUIPMENT

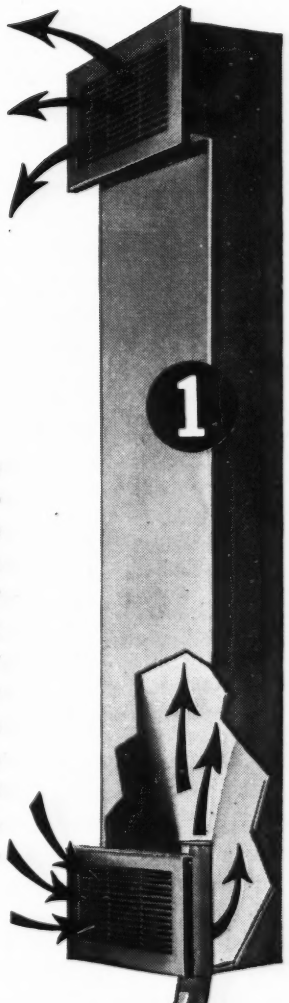
for every purse



WATER HEATERS

keep hot water on tap

A wide range of Super-Performance and Master models, 20- to 45-gallon capacity, with Jet Recovery Action that heats water faster than used. Automatic controls.



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THE PACKAGED HEATING AND VENTILATING SYSTEM

The complete 1-2-3 system that has revolutionized modern home heating. Installation as easy and simple as 1, 2, 3. (1) Magic Blenders in each room blend room air with freshly heated furnace air right in the wall; (2) 3½-in. Heat Tubes fitting any construction carry freshly heated air from furnace to the Blenders; (3) a Blend-Air furnace takes as little as 6 sq. ft. of space in basement, closet or utility room. Automatic controls. Fresh-air intake. Simplified return-air system.

Comfort costs so little with a

Coleman®

America's leader in home heating

3. Seasonal heating costs—60 cents per Mcf of gas used.

By comparison, a typical rate to the customer for a combination of all of these uses might be a fixed charge of a dollar a month or $12 a year plus a graduated block rate ranging from about 80 cents per thousand for the first 2 or 3 Mcf per month down to perhaps 50 cents per Mcf for consumptions over 10 Mcf a month. It goes without saying that such prices bear little or no relationship to the indicated costs. The minimum use customer, for example, does not begin to pay his way and both he and the utility might be better off if he were encouraged to combine his limited needs for Btu with his electric light service. Likewise, no distinction is made in the charge to a customer using gas principally for heating and another using gas principally for cooking although the cost to serve the first may be twice that of serving the second. Indeed, the rate to the heating customer actually may be less than that to the cooking customer since his large winter volume is billed at the lower blocks of the graduated rate. This paradoxical situation is made worse when it is considered that the high cost heating service, which we sell so cheaply, is non-competitive, whereas the competition from the electric utilities is constantly increasing for the low cost year-round business. It would behoove the gas companies on two counts, therefore, to increase their charges for space heating and to decrease, at least relatively, the rates for other residential services.

Interruptible Service

Another major customer classification is the interruptible industrial service. The price of this service has the least relation to its theoretical cost. In the first place, the determination of the cost itself is ambiguous. Secondly, the business is marginal and a small change in cost may abruptly change an apparent large percentage profit to a loss. Thirdly, the business is fundamentally competitive with other fuels and therefore must be priced in the first instance in relation to the cost of such other fuels. It does not necessarily follow, however, that costs can be completely disregarded in pricing this important classification of the gas business. The very fact that the price is limited by the price of competitive fuels poses a problem when such competitive fuel prices decline. Thus, if the mistake is made of putting too much dependence on revenues from this class of business during times of high competitive fuel prices, it may be impossible to recoup the losses in such revenues from other classes of service in times of depression.

The ideal situation, of course, would be for each class of business to stand on its own feet and support its own costs. In practice, however, we can only try to move gradually toward such an ideal and will probably never attain it. The fact is, we have inherited rate schedules that are in many instances completely unrelated to costs and as time passes, costs themselves, as well as the value of the service, may be rapidly changing. Under such circumstances, we in the gas business, the same as any other business, must endeavor to steer our price structure somewhere between these changing guideposts of cost and value.

Mr. Newton's third rate criterion is closely related to the second and under certain conditions the two may be contradictory. It is axiomatic, on the one hand, that a utility cannot sell its product for more than its value regardless of its cost. On the other hand, it is frequently desirable and indeed necessary to fix certain prices in excess of the indicated cost, if the price is supported by the value of the service.

I mentioned a moment ago that so-called customer costs (that is, the cost of metering, billing, and collecting, plus the fixed charges on the customer's meter and service, all of which are independent of the quantity of gas sold), might amount to $2.50 a month in a typical gas company, and I also pointed out that the corresponding minimum charge might be a dollar a month. Does this mean that the minimum charge should suddenly be increased to $2.50? I think not, for the reason that many small customers who have become used to the lower charge would consider, rightly or wrongly, that the service they were receiving was not worth $2.50. These same customers might, however, be paying an incremental charge of 60 or 70 cents per Mcf for cooking gas which carried on an indicated cost of only 30 cents per thousand, although the value of that service was undoubtedly higher than either of these figures. Based on established precedents, therefore, and in light of the practicalities, the utility collects a portion of the fixed charge, which is incurred but not paid for by the smaller customers, from the commodity component of the charge of larger customers. This is contrary to the costs involved and may be in a way discriminatory, but if the utility is to maintain good customer relations, it can correct such situations only by gradual changes in the rates. Such constructive changes, of course, should be made whenever the opportunity affords.

Commercial Service

Similar deviations are invariably found in the costs and rates for commercial and small industrial service. Here again the value of the service is high and the ability of the customer to pay is high and the tendency is therefore to fix rates substantially above cost, resulting in what amounts to a subsidy to the residential class of customers. As a matter of cold arithmetic, such rates may be unsupportable, but from the point of view of precedent and public acceptance, it is a situation that is difficult to change even if it were considered desirable to do so. Actually, I doubt very much that any such desire exists even on the part of the commercial and industrial customers themselves because the value of service to them is so much higher than the price they pay—regardless of the fact that that price may be higher than the utility's cost. I should like to distinguish here between small and large industrial users. In the latter case, where it is possible to switch more readily to a competitive fuel, the value of the service is subject to greater fluctuation and, as I mentioned previously, there is some danger to the utility in depending too heavily on profits from this class of business.

"The ideal situation, of course, would be for each class of business to stand on its own feet and support its own costs. In practice, however, we can only try to move gradually toward such an ideal and will probably never attain it. The fact is, we have inherited rate schedules that are in many instances completely unrelated to costs and as time passes, costs themselves, as well as the value of the services, may be rapidly changing. Under such circumstances, we in the gas business, the same as any other business, must endeavor to steer our price structure somewhere between these changing guideposts of cost and value."

No other source of Load Building can be so profitable *12 Months a Year* as SERVEL AIR CONDITIONING

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USES GAS ALL YEAR 'ROUND

No other equipment contributes so much to your gas load . . . no other equipment so smooths out the peaks and valleys of seasonal gas demands. For Servel is the revolutionary unit that uses heat to create both warmth and cooling . . . a truly year 'round air conditioning unit that uses only one energy source 365 days a year, GAS!

Servel teams up with GAS to give homes, stores, offices and factories air conditioning features they can get no other way: economy, cleanliness, silent and noiseless operation, no moving parts to wear in the refrigerating unit, freedom from vibration, complete automatic temperature control from 20° below to 130° above, humidifying and dehumidifying. Yes, sell Servel and you sell GAS at its very best. Together we're a team that can't be beat!

RESIDENTIAL COMMERCIAL INDUSTRIAL

Servel

AIR CONDITIONING EQUIPMENT

SERVEL, INC., EVANSVILLE 20, IND. • IN CANADA, SERVEL (CANADA) LTD., 548 KING ST., W., TORONTO, ONT.

"From a theoretical point of view, the most nearly perfect rate for combination residential service would be one that differentiated specifically between customers on the basis of the number of appliances used. Thus, a company might have a standard form of block rate applicable to all residential service, but a lower optional rate for customers using full gas service, or two or more major appliances other than space heating equipment. The disadvantage of such a rate, of course, is the cost of administration but where electric competition is severe, the extra cost may be worth while. As a matter of fact, the electric companies have in some areas used exactly this type of rate to capture the cooking and water heating load. It may be the gas companies will find it necessary in some cases to follow that precedent in order to hold their essential base load sales."

It appears therefore that although cost is ordinarily a sound criterion for minimum rates when the cost is not greater than the value of the service, value becomes the controlling factor when value is less than cost. It follows that in some cases, such as I have just illustrated, it may be necessary, where several classes of service are supplied, to adjust the rates so that each class standing alone meets the test of value, whereas the aggregate revenue of the combined classes covers the aggregate of all the costs. But, by the same token, value will still determine the ceiling for the aggregate of the classes. It is vital that these relationships be clearly identified and recognized in the determination of the respective class rates.

Combination Rates

Before concluding, I would like to add a few specific suggestions on that most troublesome schedule—the combination rate for residential service which is applicable to the great bulk of West Coast gas consumers for both year-round and seasonal usage.

The problem is not an easy one because it is difficult to separate out in a practical way consumption for space heating and other residential uses. Years ago when gas service was first being developed on a large scale, the water heating and cooking loads were considered as the basic loads and the space heating business was an incremental load that was considered highly profitable. Today, however, the situation in many companies has been completely reversed. Now the first requirement of a majority of our customers is space heating service and our sales effort must be directed to obtaining the cooking, water heating and refrigeration service, which has thus become an incremental load. The problem, of course, is that the seasonal space-heating service is a costly large volume load, whereas the year-round non-heating service is a relatively inexpensive, small volume load. It follows, accordingly, that the orthodox form of a graduated block rate tends to overcharge the non-space heating business, especially in the summer months, and to undercharge the space heating service, which is billed at the cheaper follow-on rate blocks in the winter.

One possible solution to this problem which seems to be gaining in favor is an increase in the quantity of gas in the first rate block, with a corresponding increase in the minimum or fixed charge. Such a rate form has several advantages. In the first place, it tends more nearly to compensate the utility for fixed customer costs in excess of the existing minimum charge. Secondly, it provides a method of spreading a portion of the fixed costs associated with the winter heating load over the entire year. Finally, it should provide a stimulant to year-round sales of cooking, water heating and refrigeration, since a portion of that usage is automatically included in the monthly fixed charge, and is in effect free to the customer. New rates adopted this year by Oklahoma Natural Gas Co. and by the Gas System in Long Beach, Calif., both include 1 Mcf of gas in the first block. In the case of Oklahoma Natural Gas, the fixed charge for this quantity of gas is $1.50 and in Long Beach the fixed charge is $1. Rates of this character provide the gas salesman with one of the most potent arguments for complete gas kitchens that has yet been devised.

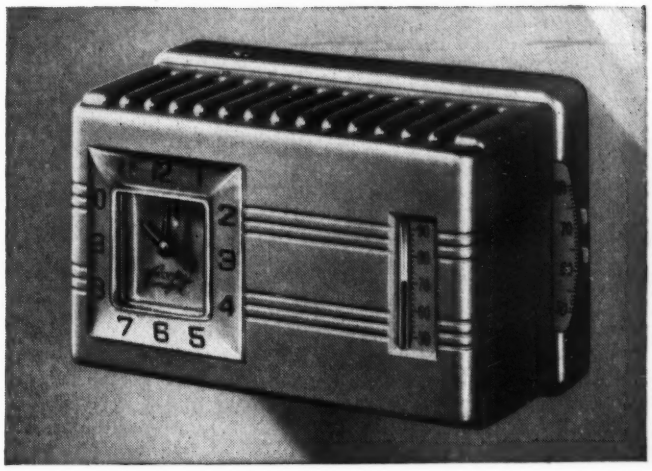
Another rate form which quite obviously reflects the higher costs of space heating is a winter-summer price differential in the commodity component of the charge. Such differential rates are common for commercial and industrial service and there seems to be no reason why they should not have merit for residential service. Assume, for example, a commodity rate of say 50 cents a thousand in the summer and 70 cents in the winter. The effect of such a rate would be to charge 60 cents on the average for year-round cooking and water heating and 70 cents for winter-time space heating. The result is to provide an automatic segregation of these services, with the seasons being the bookkeeper. A disadvantage of the rate is that it tends to increase the already heavy winter revenues and to decrease the normally light summer revenues; and it tends also to magnify the swings in revenues between cold and warm years. However, if a winter-summer rate is combined with a relatively high monthly fixed charge, the average commodity charge can be reduced proportionately and the seasonal variations can in that manner be held within reasonable limits.

Perfect Rate

From a theoretical point of view, the most nearly perfect rate for combination residential service would be one that differentiated specifically between customers on the basis of the number of appliances used. Thus, a company might have a standard form of block rate applicable to all residential service, but a lower optional rate for customers using full gas service, or two or more major appliances other than space heating equipment. The disadvantage of such a rate, of course, is the cost of administration but where electric competition is severe, the extra cost may be worth while. As a matter of fact, the electric companies have in some areas used exactly this type of rate to capture the cooking and water heating load. It may be the gas companies will find it necessary in some cases to follow that precedent in order to *hold* their essential base load sales.

In the final analysis, every utility rate problem is an individual problem. The over-all earning potential, the spread of class rates and the details of their design must reflect the particular needs and requirements of each utility. But on a broad basis, we will do well to give careful recognition to Frank Newton's fundamental criteria. Unless over-all earnings meet the test of adequacy and the level of class charges reasonably conforms with class costs and the competitive value of the service, I believe it is almost impossible to avoid long-term deterioration in a utility's financial condition and a consequent impairment of its ability to render good service to the public.

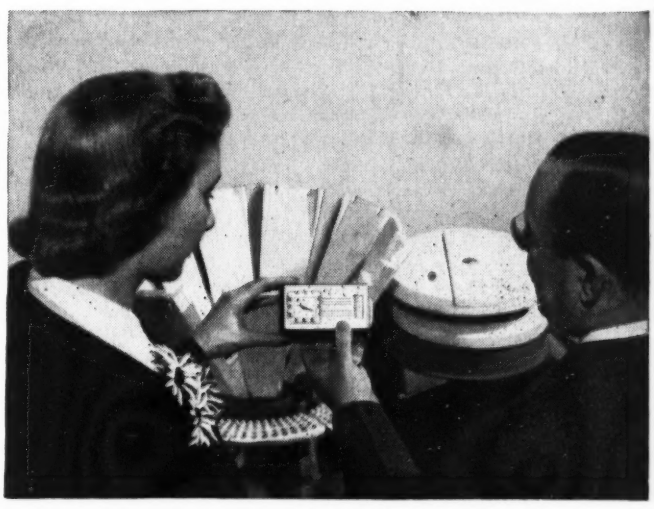
Why Chronotherms account for 9 out of 10 thermostat sales at The Brooklyn Union Gas Company



Automatic day-night heating control is the big reason why 90% of The Brooklyn Union Gas Company's thermostat customers bought Honeywell Chronotherms. This Brooklyn utility found prospects easy to sell after they learned how the Chronotherm *automatically* lowers the temperature at night for healthful sleeping—then *automatically* raises it in the morning!

Salesmen always specify Chronotherms. Because this completely automatic feature has proved so popular with customers, salesmen at The Brooklyn Union Gas Company make a habit of recommending Chronotherms on home-heating installations. They know a Chronotherm sale means another highly satisfied home owner has been added to their ever-increasing family of customers.

Big conversion project recently completed at The Brooklyn Union Gas Company



This rapidly expanding company is presently converting from manufactured to natural gas. It is the largest such project ever undertaken by a utility company.

This is the latest example of the up-to-the-minute service and facilities The Brooklyn Union Gas Company offers to its 850,000 residential customers and over 57,000 commercial customers in Brooklyn and the Queens.

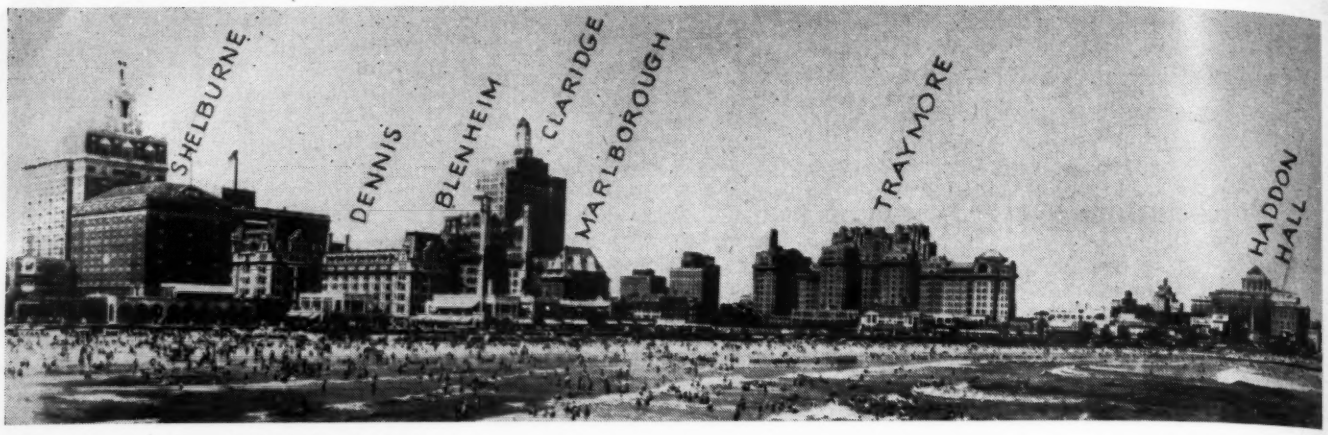
Fast, friendly service is provided by 30 modern offices similar to Jamaica office shown on left page. Here customers pay bills, request free appliance adjustment service, see new appliances and heating equipment, or get advice on home remodeling.

For illustrated literature and application data about the Chronotherm or any other Honeywell control, call your local Honeywell office. Or write Honeywell, Dept. GS-10-175, Minneapolis, Minnesota.

MINNEAPOLIS **Honeywell**

H HONEYWELL

First in Controls



Biggest Turnout Ever Expected for Convention

OVER 8000 gasmen will crowd the famous boardwalk in Atlantic City for what promises to be the largest convention in AGA history when the 34th annual meeting gets under way on Oct. 27. One of the major features of this year's convention is the exhibition to be staged by GAMA which will display over 213 different makes of appliances and equipment. (For further details on this exhibition, see the following article.)

The convention opens with a joint meeting of the manufactured and natural gas departments in the Auditorium ballroom at 10 a.m. Monday, Oct. 27. The first general session will be Monday afternoon with the treasurer's report by E. F. Barrett, Long Island Light Co. president, and AGA President Charles Bennett's review and forecast, "Where Will We Be in '53." Also on the program is Prof. Sumner Slichter, Harvard economist, who will speak on labor disputes.

Tuesday morning's general session will include Frank C. Smith, president, Houston Natural Gas Corp. and 1st v-p of AGA, speaking on sales promotion; Louis Ruthenburg, GAMA president and chairman of Servel Inc., on coordination of AGA and GAMA objectives; and Dr. Gustav Egloff, chairman, Universal Oil Products Co., on the place of gas in the present and future economy of the nation. President Bennett will also present the association awards at this session.

Wednesday morning will be devoted to sectional and committee meetings, following the home service breakfast at the Traymore hotel. The afternoon has been left free to permit visits to the GAMA exposition at the auditorium.

The Thursday morning general session will have D. A. Hulcy, president of Lone

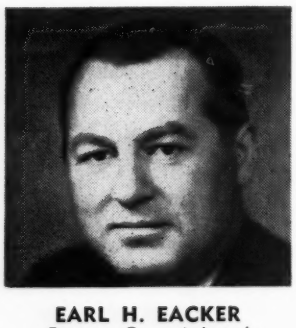
(Continued on p. 87)

Nominees for '53

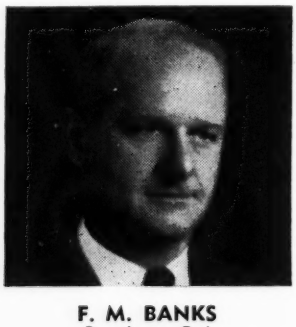
For president

FRANK C. SMITH
Houston Natural Gas

For vice presidents



EARL H. EACKER
Boston Consolidated



F. M. BANKS
Southern Cal

For treasurer

EDWARD F. BARRETT
Long Island Lighting

"Worthy of a Great Name"

ARRIVING OCTOBER TWENTY-SEVENTH

A.G.A. CONVENTION, ATLANTIC CITY, N.J.

THE NEW *Caloric*

AUTOMATIC GAS CLOTHES DRYER

CALORIC STOVE CORPORATION, TOPTON, PENNSYLVANIA

For directors

E. R. ACKER
Central Hudson Gas

L. B. BONNETT
Con Ed

E. J. BOOTHBY
Washington Gas

D. B. W. BROWN
Milwaukee Gas

A. W. CONOVER
Equitable Gas

N. H. GELLERT
Seattle Gas Co.

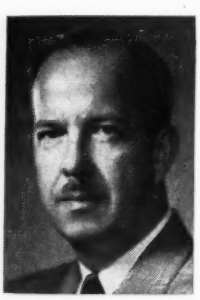
LYLE C. HARVEY
Affiliated Gas

FREDERIC O. HESS
Selas Corp.

R. A. HORNBY
Pacific Lighting

PAUL KAYSER
El Paso Natural

J. F. OATES JR.
Peoples Gas



W. T. STEVENSON
T G T

R. G. TABER
Atlanta Gas

G. E. WHITWELL
Philadelphia Elec.

C. G. YOUNG
Springfield Gas

PROGRAM

Monday, Oct. 27

10 a.m. Joint meeting, natural and manufactured gas departments: Ballroom auditorium

2 p.m. General session: Ballroom auditorium

5 p.m. Executive board: Belvedere Room, Hotel Traymore

9 p.m. President's reception, floor show and dance: Ballroom auditorium

Tuesday, Oct. 28

10 a.m. General session: Ballroom auditorium

12:30 p.m. Luncheon Meetings

Industrial and commercial gas section: Rose Room, Hotel Traymore

Accounting section: Rut'and Room, Haddon Hall

Corporate Secretaries: West Room, Haddon Hall

Rate committee: Mandarin Room, Haddon Hall

Insurance committee: Board Room, Claridge Hotel

Home Service round table: Belvedere Room, Traymore

2 p.m. Ladies party

Section meetings

Residential gas section: Trimble Hall, Claridge

Operating section: Renaissance Room, Ambassador

Personnel session: Tower Room, Haddon Hall

8 p.m. GAMA Exhibition
Open until midnight with special entertainment

Wednesday, Oct. 29

8 a.m. Home Service breakfast: American dining room, Hotel Traymore

10 a.m. Industrial and commercial gas & residential gas section (joint meeting): Trimble Hall, Claridge

Section meetings

Operating section: Renaissance Room, Ambassador

Customer accounting group: Viking Room, Haddon Hall

General accounting group: West Room, Haddon Hall

Accident prevention committee: Venetian Room, Ambassador

9 p.m. Entertainment and dance: Ballroom auditorium

Thursday, Oct. 30

10 a.m. General session, Ballroom auditorium

12:30 p.m. Luncheon meeting

Accident prevention committee: Harlequin Room, Ambassador

2 p.m. Operating section: 22 Club, Ambassador

9 p.m. GAMA entertainment: Ballroom auditorium

(Continued from p. 80)

Star Gas Co., speaking on public relations; Senator Herbert R. O'Conor, of Maryland, on "Economic Freedom—The Foundation of Liberty"; and Tom P. Walker, Irving Trust Co., on "Earnings Needs for Gas Companies From the Investor Standpoint."

Section meetings tentatively include the following speakers:

Industrial and commercial: E. M. Gretzler, National Supply Co., on "The World Petroleum Situation" and F. A. Kaiser, Detroit-Michigan Stove Co., on deep fat fryer research.

Residential gas section: W. J. Schmidt, Long Island Light Co.; Howard D. Valentine, People Gas, "The Death of a Salesman"; W. D. Williams, New Jersey Natural Gas, "Pattern for Profits"; C. S. Stackpole, Eureka Williams Corp., "To Sell, Ya Gotta Tell"; W. Paul Jones, Servel Inc., "Operation Achievement."

Accounting section: Dr. Howard Aiken, Harvard University, on automatic computing machinery; Marvin K. Collie of Vincent, Elkins & Weems on deferred compensation arrangement; Vera Green, Botwinik Bros. of Massachusetts Inc., "Women in Management."

Operating section: Dr. S. C. Schroeder, U. S. Bureau of Mines, "Synthetic Liquid and Gaseous Fuels"; C. F. DeMey, Col. Gas Service Corp., on reserves and projected demand for natural gas and the economics of substitution; E. L. Henderson, United Gas Corp., on odorization.

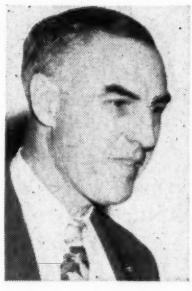
Personnel relations section: David C. Moore, University of Chicago, "A Method of Measuring Employee Morale"; Eskil I. Bjork, Peoples Gas Light & Coke, "Management Decisions and Actions."

Industrial and commercial gas and residential gas sections joint meeting: W. L. Hayes, Montana-Dakota Utilities Co., "Facing Up to Facts"; George R. Walton, United Gas Pipe Line Co., "Increased Use of Natural Gas in the Chemical Industry"; Tracy B. Madole, Magic Chef Inc., "Commercial Cooking and the Gas Company."

Accident prevention committee: E. H. Eacker, Boston Consolidated Gas Co., "The AGA Executive Safety Committee, Its Aim and Ultimate Goal"; G. J. Stone, Utilities Mutual Insurance Co., "The Rising Compensation Costs in the Gas Utility Industry"; James V. Carpenter, Long Island Lighting, "Accident Prevention Among the Brass—When-Why-Who"; John Sherwin, Mine Safety Appliance Co., "The Value and Use of Gas Detecting Instruments"; William Rogers, Ebasco Services, "Safety Seminars."

For Chairmen of the Sections

B. S. RODEY
Con Ed
Accounting



TERRY HART
Nashville Gas
Indust. & Com.

R. J. VANDAGRIFF
Laclede Gas Co.
Residential Gas

C. W. WILSON
Con. Gas Elec.
Operating

A. F. BRIDGE
Southern Counties
Lab Managing

G. LEFEBVRE
Cooper-Bessemer
Manufacturers

W. M. KIMBALL
Columbia Gas Sys.
Pub. & Adv.

For Vice Chairmen

PAUL E. EWERS
Michigan Con
Accounting

C. C. EELES
Ohio Fuel Gas Co.
Indust. & Com.

RAYMOND LITTLE
Equitable Gas Co.
Residential Gas

F. J. PFLUKE
Rochester Gas
Operating

C. H. WARING
Gas Service Co.
Lab Managing

Over 200 GAMA Exhibits Will Fill Atlantic City Auditorium

More than 200 domestic, commercial, industrial, and transmission displays, an all-time record, will be featured at the biennial exhibition of the Gas Appliance Manufacturers Assn. in Atlantic City, Oct. 27-31. Harold Massey, manager of the exhibition, reports that 171 manufacturers will display 213 items in booths covering more than 75,000 sq ft of floor space in the huge Atlantic City Auditorium.

Manufacturers of domestic appliances and equipment lead in the number of displays with 16 featuring gas ranges, 17 water heaters, one refrigerator, four clothes dryers, four incinerators, seven kitchen cabinets, 16 room heaters, and 46 central house heating systems. In addition there will be seven unit heater exhibits, two showing commercial cooking equipment, eight on industrial gas equipment, and 35 featuring controls and related accessories. More than 15 exhibitors plan displays of cooking utensils, blowers, home insulation, repair parts, burners, and other smaller items used by or in the manufacture of gas appliances. Of particular interest to visitors will be 28 exhibits of equipment used in the production and transmission of natural gas.

Exhibition hours will be from 9 a.m. to 6 p.m. Monday through Thursday, except for Tuesday evening. The exhibition will be open Tuesday evening from 8 p.m. to midnight to give added time for utility executives to visit it on this particular evening which is free of any official convention functions or entertainments. A special program is planned for that evening to attract a large attendance. On Friday, the exhibition will be open from 9 a.m. to 12 noon.

GAMA plans to serve up a liberal sprinkling of beauty and entertainment. Selection of "Miss Gas Flame of 1952" from among 10 models is one of the attractions on the lighter side that have been planned. Bob Russell, who for years conducted Atlantic City's Miss America contest as well as the Miss Universe contest, will be master of ceremonies during the beauty pageant Tuesday night. The contestants will wear bands representing regional gas areas such as Miss Florida-Georgia Gas and Miss Mid-West Gas. Miss Gas Flame of 1952 will be selected by audience approval, as registered on an applause meter.

Opening night will be marked by the AGA president's reception, while Thursday night has been set aside as gas appliance dealers' night with a variety show to be held in the ballroom. In addition, those who attend the exhibit will be eligible for the daily door prize GAMA will give away. Television sets, luggage, radios and radio-phonographs, golf clubs, wrist watches, hand-powered tools, and home appliances will be given away. Other entertainment during the exhibit includes Ben Yost's Octette, Lester Cole's Chansonettes, and Joe Sterns' Boardwalk orchestra.

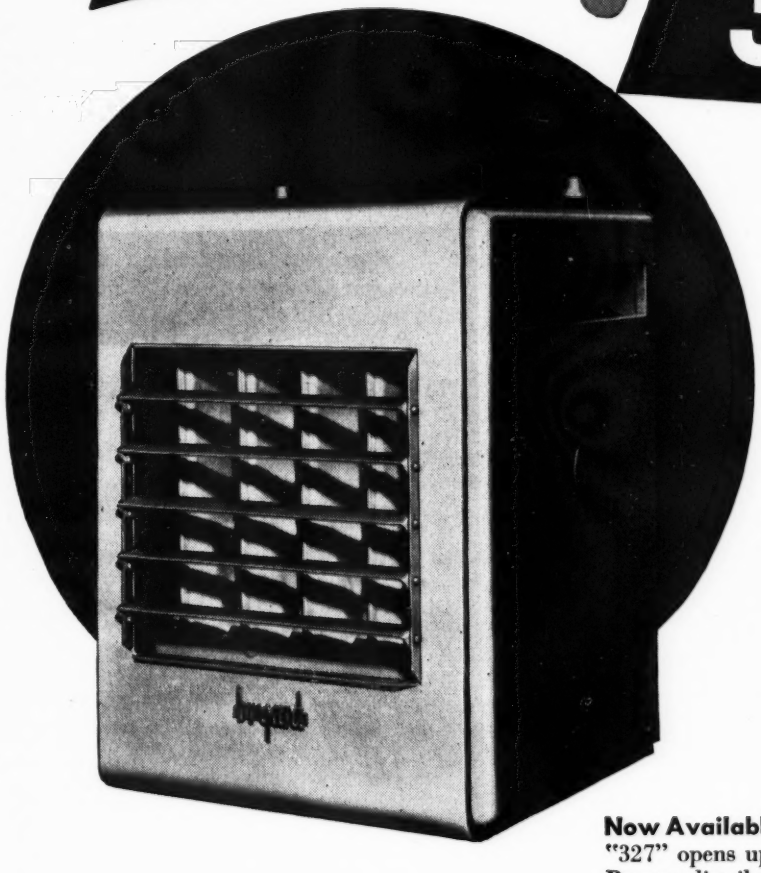
The interior of the Atlantic City Auditorium where over 200 displays of appliances and equipment will be exhibited.

IT'S NEW

IT'S BETTER

IT'S bryant's SENSATIONAL

"327" UNIT HEATER



Sets NEW standards in . . .

Quiet Operation . . . NO narrow passages to cause whistling . . . it's open, streamlined—efficiently designed to HUSH the air flowing through.

Compactness . . . the "327" installs within inches of ceiling, saving space. It's lighter, easier to handle, easier to install.

Comfort . . . no cold blasts at start of cycle. Fan won't start until the heat exchanger is warm enough to assure comforting heat.

Long, Trouble-free Performance . . . the "327" retains its high efficiency for life. Efficient Venturi tubes provide longer, trouble-free service, less heat loss up the flue.

Extra-Sensitive Controls . . . responsive low-voltage controls mean better, more uniform heat. Safety controls prevent overheating.

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Now Available in All Popular Sizes—Yes, the revolutionary Bryant "327" opens up hundreds of new unit heater sales for you. See your Bryant distributor today or write Bryant Heater Division, Affiliated Gas Equipment, Inc., Dept. 107, 17825 St. Clair Ave., Cleveland, Ohio.

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for the Asking!

Call your Bryant distributor for your copy of this 20-page, fully illustrated book which provides helpful information on specifying, installing and properly locating unit heaters.

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HEATING AIR CONDITIONING • WATER HEATING

Training Personnel to Safely Operate L.P. Gas Plants

By S. C. SYMNOSKI
The Philadelphia Gas Works Co.
Philadelphia

THE introduction of L.P. gas into the gas making process of the Philadelphia Gas Works Co. brought us into a new field in which our management recognized a real need for fully training our supervisory and operating personnel to give assurance of the safe and orderly operation of the L.P. gas plant.

Although considerable information and specific recommendations are available on the proper design and operation of L.P. gas plants and their auxiliary equipment, compiled from contributions of industry and associations (e.g., the National Fire Protection Assn., NBFU, etc.), and the need for trained men for the operating job is recognized by the industry and regulatory bodies, there are presently available no recommendations as to what constitutes a well trained operator, how to train him, and how to keep him alert to the demands of his job. Infrequent, intermittent operation necessitates a refresher training program.

Our program, to a great extent exploratory, and by no means complete, is presently serving us well in maintaining our operating personnel conditioned to safe L.P. gas operations.

The present installation at our station "A" plant consists of 18 tanks each having a 30,000-gal. displacement, with conventional accessories and trim. Eight additional tanks are to be installed at the farm this summer, thereby making available a total storage capacity at the plant of approximately 650,000 gal. A similar installation of 20 storage tanks and auxiliary equipment is now in process of construction at our station "B" plant.

Present auxiliary equipment consists of tank car and truck unloading facilities, liquid transfer pumps, vaporizers, L.P. gas-air jet compressors, and cold enriching facilities.

The two liquid pumps have a capacity of 21,000 gal. per hour each. They are 5-stage, vertical centrifugal pumps driven by 50 hp electric motors. The pumps are used to transfer L.P. gas from the tanks to the vaporizers or to transfer liquid from tank to tank.

There are two vertical type vaporizers using 125-lb steam as the source of heat. Each has a vaporizing capacity of about 10,000 gal. per hour. The vaporizers are housed in a brick building adjacent to the L.P. gas modification plant.

The L.P. gas modification plant consists of five Schutte-Koerting jets, vapor meters, thermeter, vapor pressure regulator, and other related controls. The jet compressors have a total capacity of 1725 Mcf/hr at 650 Btu. The cold enriching equipment, such as regulator, orifice, meter, and remote controlled butterfly valve, has a capacity of approximately 430 Mcf/hr of L.P. gas.

The present use of L.P. gas in our process is reserved for standby in event of a natural gas failure or a serious curtailment, and for peak shaving. A natural gas failure or a substantial curtailment has a terrific impact on our gas making capacity during the interim of making ready water gas sets and bringing them to required Btu and capacity. Because of this impact, at certain load levels it is imperative that the L.P. gas equipment be placed on stream from a shut-down condition within one hour. To accomplish this with safety it is necessary that all of the operating personnel are well trained and maintained in a state of readinesss.

The L.P. gas installation is manned around the clock with one operator. When the plant is in a shut-down status, he serves as a security and fire watch. He observes and makes record of liquid temperatures, pressures, and liquid levels. He patrols the farm and vaporizer area, alerted for fire hazards, infringement of safety regulations, and illegal entrances to the area. He makes record of all personnel

I. GENERAL
  (A) General information on L.P. gases.
  (B) General description of Station "A" installation.
    1. The tank farm.
    2. The unloading system.
    3. Liquid-transfer pumps and lines.
    4. The vaporizers.
    5. L.P. gas-air installation.
    6. L.P. gas cold enrichment installation.
  (C) Specifications of major equipment and instruments.

II. RECEIPT AND UNLOADING PROCEDURE FOR L.P. GASES
  (A) Description of the unloading facilities.
  (B) The unloading procedure.
    1. Tank car.
    2. Tank truck.

III. OPERATION OF THE TANK FARM
  (A) Routine care (temperature and pressure reports, leak testing, inventory, sprinkling systems, etc.)
  (B) Procedure for using the L.P. gas (starting and shutting down).
    1. With the transfer pump.
    2. Without the transfer pump.
  (C) Use of liquid line to vaporizers.

IV. THE OPERATION OF THE VAPORIZERS
  (A) Description of controls and methods of control.
  (B) Procedure for starting vaporizers.
  (C) Procedure for shutting vaporizers down.

V. OPERATION OF COLD ENRICHMENT FACILITIES
  (A) Description of controls and methods of control.
  (B) Procedure for starting cold enrichment.
  (C) Procedure for shutting cold enrichment off.

VI. THE OPERATION OF L.P. GAS-AIR EQUIPMENT
  (A) Description of controls and methods of control.
  (B) Procedure for starting the use of L.P. gas-air.
  (C) Procedure for shutting L.P. gas-air equipment down.

VII. STANDING ORDERS

VIII. SAFETY ORDERS

IX. SELECTION AND PROPER USE OF SAFETY TOOLS

X. FIRE PROTECTION EQUIPMENT

XI. A DESCRIPTION OF L.P. GAS FIRE FIGHTING METHODS AND THE PROPER USE OF THE FIRE FIGHTING EQUIPMENT

XII. THE CALCULATIONS AND THE RECORDS NECESSARY TO DETERMINE THE L.P. GAS VAPORS USED
  (A) Cold enrichment.
  (B) L.P. gas-air.

Fig. 1. Manual of operation for L.P. gas plants.

Presented at the AGA production and chemical conference in New York, May 26-28.

Demonstrate the

CONVENIENCE OF ALLTROL® CENTER SIMMER

and you sell the gas range!

Use These Tested and Proved Selling Points:

1. *Alltrol* has widest range of heats available on any surface cooking unit.

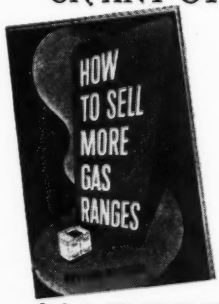
2. *Alltrol* "clicks" into position for flexible *Center Simmer* and *Keep-Warm* . . . ends wide searching for the right cooking heat.

3. Gentle boiling of the *Center Simmer* prevents messy boilovers, scorching, burning . . . means faster bringing to a boil because less water is needed.

4. *Alltrol* keeps kitchens as much as 9° Cooler . . . ends stifling humidity.

5. *Alltrol* has ideal *Keep-Warm* heats . . . 130° to 175° . . . keeps foods just right for delayed meals, late guests.

Conclusion: "ALLTROL" HAS A COMBINATION OF CONVENIENCE FEATURES NOT AVAILABLE ON ANY OTHER SURFACE COOKING UNIT!



Write for names of gas ranges featuring the "ALLTROL CENTER SIMMER."

Send for this FREE Booklet "HOW TO SELL MORE GAS RANGES." Address: Dept. 102G

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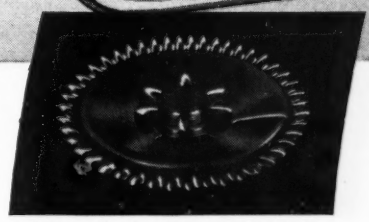
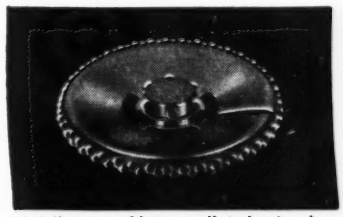
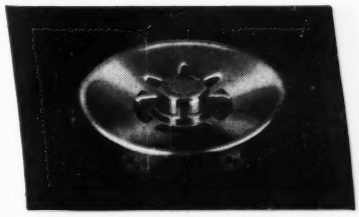


Full flame Starting Burner for quick boil or fast frying.



A full range of intermediate heats when wide spread of heat is needed.



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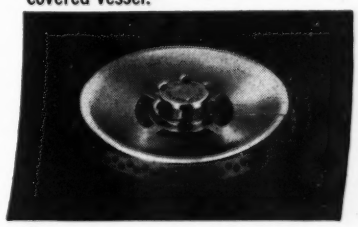


Click . . . a gentle "Keep Warm" heat . . . without further cooking.

HARPER-WYMAN COMPANY

8562 VINCENNES AVENUE • CHICAGO 20, ILLINOIS

"ALLTROL CENTER SIMMER" *Makes Gas the Winner*

ALLTROL CENTER SIMMER

Date.....

Storage Tanks Used.....

Time On	L.P. Gas Pump Used "A"	"B"

Operator.....

BE SAFE — NOT SORRY

1. Emergency valve, closed .....
2. Main power switch, "On" .....
3. Tank reading (liquid level, temperature, pressure) on selected tanks recorded .....
4. On tanks selected: a. Bottom "liquid-out" valves, opened ..... b. Top "liquid-out" valves, opened; c. Equalizing valves, opened .....
5. Pump suction valve, opened .....
6. Pressure pilot line and outlet valves on Fisher by-pass regulator, opened .....
7. Transport line valve under 10A tank, opened .....
8. If "B" pump is being used, 6-in. division valve at 10A tank, opened .....
9. Power house notified pump going on .....
10. Circuit breaker or breakers "On" .....
11. Starting switch, "On" .....
12. Inlet valve Fisher by-pass regulator, opened .....
13. By-pass valve around Fisher regulator opened to maintain 175 psi on outlet of pump .....
14. Pump discharge valve, opened .....
15. Liquid now up to emergency valve, valveroom foreman notified .....

If tank pressure is high enough to satisfy vaporizers, the following will apply:

1. Emergency valve, closed .....
2. Tank reading (liquid level, temperature, pressure) on selected tanks recorded .....
3. On tanks selected: a. Bottom "liquid-out" valves, opened ..... b. Equalizing valves, opened .....
4. Suction by-pass and 6-in. division valves, opened .....
5. If "B" battery is being used, 6-in. division valve at 10A tank, opened .....
6. Transport line outlet valve under 10A tank, opened .....
7. Liquid now up to emergency valve, valveroom foreman notified .....

Fig. 2 above: Starting check-off list at L.P. gas tank farm.

VAPORIZERS — COLD ENRICHMENT

Date.....

Time On	Vaporizer Used No. 1	No. 2

Operator.....

1. Temperature recorders, pressure controllers, vapor meters and thermeter prepared for operation .....
2. Main condensate alarm switch, "On" .....
3. Vehicle stop signs, placed .....
4. Plug valve at coke oven main, open .....
5. By-pass and inlet valves cold enrichment regulator, closed .....
6. Outlet valve cold enrichment regulator, open .....
7. Cold enrichment butterfly valve, closed .....
8. By-pass and inlet valves modification regulator, closed .....
9. Outlet valve modification regulator, open .....
10. Prepare for operation the desired number of modification jets: (a) Inlet plug valves, open; (b) Air check valves, closed; (c) Mixed gas valves, open .....
11. Vapor outlet valve on vaporizer not being used, closed .....
12. Instrument supply air, "On" .....
13. Steam tracer lines, "On"—traps operating .....
14. Gauge and instrument line connections, open .....
15. Steam and L.P. gas liquid controllers set at zero .....
16. Fisher "leveltrol" set for No. 6 High and No. 1 .....
17. Leveltrol valves, open .....
18. Sludge blow-down valves each vaporizer, closed .....
19. Liquid inlet and by-pass valves, each vaporizer, closed .....
20. Emergency valve, open .....
21. Steam controller, set 3 to 5 psi .....
22. On each vaporizer, steam trap inlet and outlet valves open, by-pass closed .....
23. Chain operated steam valve, open .....
24. Steam line bled for moisture .....
25. Main steam valve, open .....
26. Condensate alarm switch, "On" .....
27. Liquid inlet plug valves, open .....
28. L.P. gas liquid controller set to 100 psi in four or more steps .....
29. Inlet valve modification regulator open—and regulator set for a static pressure of 73 psi .....
30. Thermeter selector switch set for desired sequence .....
31. Inlet valve cold enrichment regulator open—and regulator set for a static pressure of 40 psi .....
32. Cold enrichment butterfly valve opened to obtain desired rate of flow .....
33. If second vaporizer is needed repeat steps Nos. 14-15-16-17-21-23-24-25-26-27-28 .....
34. Vapor outlet valve, second vaporizer open .....

Fig. 3 (right) : L.P. gas starting check off for modification.

entering and leaving the restricted area, other than posted operating personnel. On a scheduled routine he checks manheads on tanks, valves, flanges, stuffing glands, relief valves, etc. for leaks, using a portable explosimeter. He is responsible for housekeeping in the farm area, vaporizer room, and control area. He has full authority to halt any work or activity when, in his judgment, such work or activity constitutes a hazard. Such stop orders are binding on all personnel, and authorization to review and countermand such stop orders is only given to a few top supervisors. He assists in the unloading of L.P. gas to storage under the direction of a supervisor.

When the plant is in operation, the area attendant operates at the farm only, tending the liquid pumps and lines, shifting tanks, and maintaining operating records.

A second operator is used in conjunction with the operation of the vaporizers, modified L.P. gas and cold enriching, changing rates to accommodate load and interchangeability requirements. This operator normally functions in natural gas service as affecting modified natural gas plant, cold enriching, metering, odorization, and interchangeability control. Both operators are equally trained in both phases and are regularly interchanged as a means of "on-the-job" training.

In their consideration of the problems inherent in liquefied petroleum gas operations, management decided that the study of L.P. gas usage, safety policies, and the initial training of operating personnel would require the full time of a technically trained supervisor, well in advance of the completion of the L.P. gas plant. In September 1950, eight months before completion, a shift supervisor with substantial gas plant operating background was relieved of his current duties and assigned to this work exclusively. His duties were to investigate L.P. gas plant operation in all its phases, including operating procedures of others in the industry.

Arrangements were made with many gas companies in the New York and New Jersey areas for visits to plants where liquid petroleum gas was in general use. Detailed reports of the installations visited were written listing the various types of equipment in use, operating difficulties, if any, and the type and number of men required to operate the plants properly. We drew freely from this information to develop our own operating procedures and practices. The result of their direct contact with the experienced operators in these plants greatly aided in the development of the training supervisor and others in our supervisory group who were included in the inspection of the plants.

Throughout the period of construction and installation of the L.P. gas equipment, the training supervisor maintained liaison with the contractor, manufacturers' representatives, and our own engineering group to the end that plant management and other operating personnel

were kept well informed of details of construction and the potential operating problems involved in the use of the equipment. Daily reading and studying of considerable technical data on equipment to be installed and daily contact with men having considerable background, both in operations and design, rapidly developed our training supervisor. In a relatively short time he was able to competently advise plant management on the training methods to adopt, safe practices and operating procedures best suited for our local conditions and needs. Assurance was had by plant management that the impending L.P. gas operations were being given undivided attention with a minimum of upset and concern to the operators currently carrying on the normal business of the day.

On completion of the L.P. gas system, the training supervisor was active in the purging operations prior to loading the farm. He directly supervised the unloading to storage of all the tank trucks and tank cars required to fully load the farm. During the period of the initial loading, a training schedule was designed whereby those shift supervisors who would be involved in the operation of the L.P. plant were trained in the proper unloading procedure under the direction of the training supervisor. It is not our intention to involve all shift supervisors in unloading liquefied petroleum gas but we believe an appreciative knowledge of the proper procedure is necessary. A few selected supervisors now direct the unloading of L.P. gas to storage.

Shift Supervisors

Concurrent with the development of the training supervisor, other shift supervisors were oriented to liquefied petroleum. Literature was given them, covering L.P. gas plant design, description of all auxiliary equipment, the chemistry and characteristics of liquefied petroleum gases, and established operating techniques of other plants. Some of the key men of this group visited other L.P. gas installations with the training supervisor. Group meetings of the supervisors were held with the training supervisor guiding the discussions and feeding the group new and additional information.

These group meetings were held both in our training room and in the field. While construction and installation was still in progress, auxiliary equipment such as excess flow valves, relief valves, pumps, magnetron gauges and other control equipment were examined, and their operation explained to the group. Large schematic drawings were made of various units for the L.P. gas system and were used in conjunction with the training room sessions. As the training of the supervisory group progressed, many differences of opinion were noticed on operating technique. It was soon recognized that standard operating procedures had to be developed, but it was unanimously agreed that actual L.P. gas operations had to be experienced many times before hard and fast operating instructions could be released. The next step in our training program was the development of the L.P. gas operating manual.

With the completion of the plant, ample opportunity was given to the supervisory group under the direction of the training supervisor to make many practice and actual runs. The supervisory group was so scheduled that they participated in some, if not all, the trial runs in the initial testing of the equipment and tests made to check the capacity of the auxiliary equipment. Procedures for the operation of the tank farm equipment, vaporizers, and controls were written up and submitted to the group for study and constructive criticism. Safety orders and practices were developed, discussed at plant safety meetings, and finally written up for inclusion in the manual. One of the supervisory group with a talent for practical drawing developed many simple but effective drawings for the manual. O. B. Holman, supervisor of gas processing, who had done a commendable job on a similar manual on generator house operations and practices, took on the job of compiling, arranging, and editing the final manual. The table of contents of the manual in its present form is presented in *Fig. 1.*

All operating personnel were furnished with a manual for individual use and study. It is recognized that as more operating experience is gained, improved operating technique will be developed, and revisions and additions to the manual must follow. It is the function of the supervisor of the operating division of the plant directly responsible for L.P. gas operations to keep the manual up to date with current practices.

A group of nine men was selected as trainees. Each man was a qualified gasmaker. They were divided into three groups and each group in turn was given six days of concentrated instruction on the activities involved in the operation of an L.P. gas plant. The instruction given at this time was principally in the form of classroom lectures, study, and discussion periods under the direction of the training supervisor. The operating manual was not completed at this time, but preliminary drafts of the principal chapters were distributed and used for reference at the sessions. Copies of the *Handbook Butane-Propane Gases* were made available to the group for use as text books. Principal emphasis was given to the study of the properties of L.P. gases, fire protection and control, safety practices, and orientation to the equipment of the plant. Films and slides showing the methods and equipment used in fighting and controlling L.P. gas fires were shown. In addition to the classroom work, a daily tour of the plant was made and the instructor explained the operation of integral parts of the plant, their function, and their design. Toward the end of the orientation period, each group made about eight "dry" runs of the equipment and finally several actual runs, all of which were closely directed by the instructor. On completion of this training assignment, the men were scheduled to a shift as L.P. gas plant area attendants for security, safety and fire watch service, and a new group was started in the orientation classes. While on duty as area attendants, the men continued making dry runs from time to time under the direction of the shift supervisor.

Training Runs

After the entire group had completed the orientation training, and all shifts were covered with two men, actual training runs were made. The plant was operated daily under direction of the training supervisor with L.P. gas area attendants and shift supervisors participating. By scheduling these training operations at shift changing time, morning and evening, and holding men over, a greater number of personnel were able to participate in each run made. Daily training runs were made for about a month after which it was considered that all operators were fully qualified to operate the L.P. gas equipment with a minimum of direct supervision. With the completion of the training program to this point, the service of a full-time instructor was not necessary and he was returned to his former duties.

While this paper is principally concerned with the training of operating personnel, all other personnel should be made conscious of the safety practices rigidly enforced in the L.P. gas area. All maintenance supervisors were issued a copy of the manual to give them an appreciative knowledge of L.P. gases, the

equipment installed, its function and safety practices.

The rigid adherence to the plant rule that all personnel, other than posted operating personnel, require a pass to enter the L.P. gas area, and the activities of the area attendant are daily reminders of safety to all workmen within the area.

With the completion of the formal training program, the maintainance of the know-how of the operating personnel became the function of the supervisor directly in charge of the L.P. gas plant activities. A program of refresher dry runs and actual operations is in practice on a scheduled basis. The schedule presently in use gives each operator two dry runs and one actual run each week. A record is kept of each man's activity in L.P. gas operations to assure equal distribution of dry and actual runs among the group. The present schedule of actual runs for refresher training requires the use of about 10,000 gal. of L.P. gas each month.

Check-off lists, as shown in *Figs. 2* and *3*, are used by the operators each time the plant is activated. The use of check-off lists is strongly recommended as a means of reminding the personnel of proper and orderly procedure in placing the equipment in operation.

The Philadelphia Gas Works Co. is now making ready equipment and other related facilities for the establishment of a fire fighting and fire control school. A course will be set up at the school to train our L.P. gas operators in the methods of fighting and controlling L.P. gas fires. Pending the completion of this school, the operators are drilled in the use of the fire fighting equipment and from time to time given class instruction by the plant safety and security officer.

From the date the L.P. gas plant was available for use, to the present date, a period of one year, we have used approximately 175,000 gal. of liquid petroleum for training purposes. When consideration is given to the enormous potential energy of the liquefied petroleum gas in storage within our plant our belief is that well trained men should be used in every function of L.P. gas operations and that the cost of the program is justified.

While lectures, manuals, and dry runs are extremely helpful as training mediums but are not in themselves sufficient, actual operation of the L.P. gas equipment on a scheduled basis is the only practical way we know of that will keep the operators skilled in the safe and proper handling of L.P. gas.

Operating Ideas

A Radial Flow Wet Dust Collector

This device relates to dust collectors and has been designed to provide a wet dust collector of high efficiency and simple compact construction. Objective of the invention was to provide a means for (1) impinging relatively narrow air streams on greatly extended areas of wetted surface; (2) causing a sharp change in direction and impingement on wetted surfaces of the gas stream to be cleaned; (3) adjusting the impact velocity of laden gases against wetted surfaces; (4) increasing the impact velocity in successive wet separating stages to increase the effectiveness of the separation on the finer dust particles; (5) devising a structure for obtaining a high degree of wetted surface impingement together with change in direction of relatively narrow air streams with a minimum of resistance to air flow; (6) providing an efficient wet separator having low-resistance linear air flow; and (7) providing a wet separator having low-resistance linear air flow through a plurality of wetting sections and through a liquid eliminating section.

In the accompanying drawings, *Fig. 1* is a vertical elevation, partly in section, of one embodiment of the invention. *Fig. 2* is a compound horizontal cross section taken on the line 2-2 of *Figs. 1* and *3* looking in the direction indicated by the arrows. *Fig. 3* is an enlarged vertical section, partly in elevation, taken on the line 3-3 of *Fig. 2* looking in the direction of the arrows.

In the embodiment of the invention shown in the drawings, the apparatus comprises a vertical casing, or column 1, made up of several sections, or stages 1a, 1b, 1c, 1d, respectively. The section 1a, as best shown in *Fig. 2*, is preferably provided with a tangential gas inlet (2) and a hopper bottom (3) having a sludge outlet (4).

—Patented by W. O. Vedder
Pangborn Corp.
Hagerstown, Md.

Fig. 1.

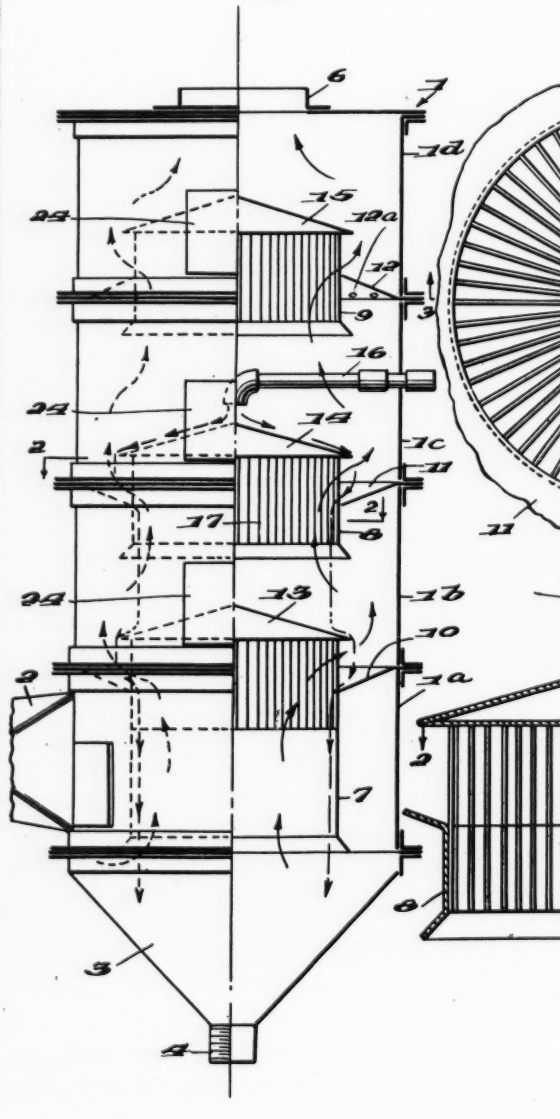


Fig. 2.

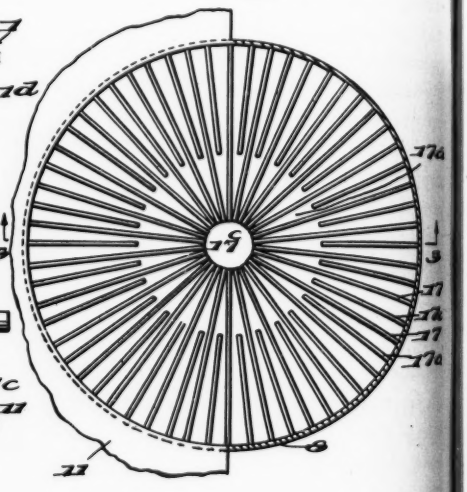
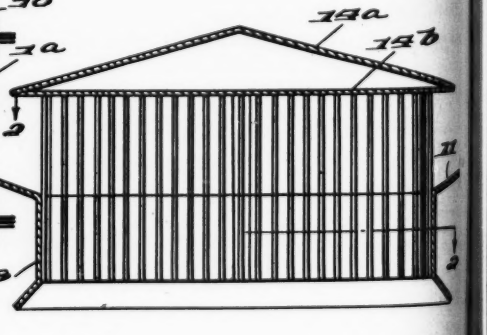
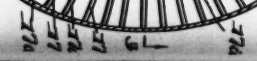


Fig. 3.





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D. Vedder

UNITED

Odicator

ACCURATE:

Hundreds of field tests have proven the reliability of ODICATOR READINGS.

SAFE:

Releases only a minute quantity of gas when test is being made . . . entire unit is designed to maintain maximum safety.

SIMPLE TO OPERATE:

Open needle valve until distinct odor is detected—press red button—read gauge which indicates concentration of gas in air.

PORTABLE:

Only 3" x 6" x 7"—weighs only 80 ounces—equipped with handle—carrying case available.

STURDY:

Made of durable materials—carrying case affords added protection.

ATTRACTIVE:

Striking, modern, streamlined design.

INEXPENSIVE:

Priced within reach of the smallest operator.

Tests may be taken anywhere within the distribution system—at the town border station, the tank car, industrial or commercial installations or in the consumer's kitchen.

Meets the requirements of various Utility Commissions, Insurance Companies, State and Federal agencies for an accurate, safe, exacting test of odor intensity.

Has been designed to assure safety of operation under all conditions . . .

Is not intended for use in determining locations of combustible mixtures in the atmosphere.

SEE DEMONSTRATION AT ATLANTIC CITY BOOTH No. 803

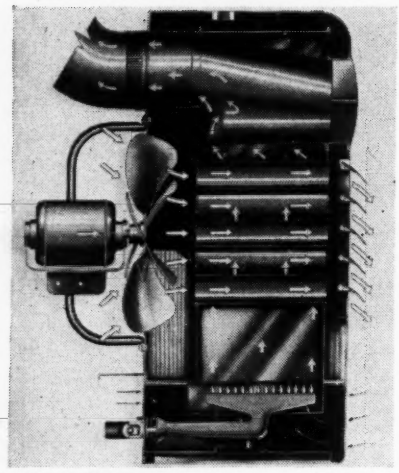
DESIGNED AND MANUFACTURED BY:

UNITED PETROLEUM GAS CO.

806 Andrus Building, Minneapolis 2, Minnesota

New Products and Trade Literature

To secure further information on products or new literature, simply fill out the coupon and mail, indicating by number the information or literature needed.

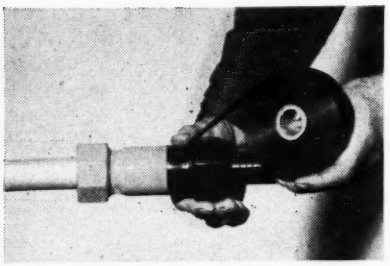


1 Unit Heater

A new line of gas-fired unit heaters, ranging in capacity from 50,000 to 230,000 Btu per hour input, has been introduced by Trane. Outstanding feature is the heat exchanger, "built like a boiler," with staggered horizontal steel tubes to provide maximum areas of prime heat surface. The steel tubes are rolled into heavy end sheets, boiler tube style, and are fortified with additional outer and inner flanges. No cement or gaskets are used in the heat exchanger.

The heat generator includes burner heads and mixing tubes of one-piece cast iron construction. Burners, pilot, and control valves are combined in one removable drawer-type assembly. Built-in safety controls include a high-limit switch to prevent over-heating, and automatic cut-off of both pilot light and main gas supply.

The Trane Co.

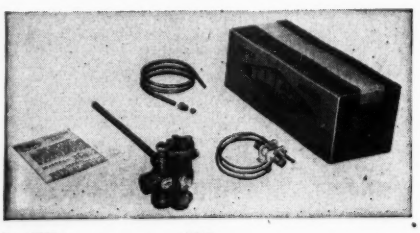


2 Pipe Tape

The new polyvinyl chloride pipe tape produced by Dresser Manufacturing division is now available in 1-in. width, particularly suitable for wrapping fittings. Called Dressertape, it possesses insulation resistance of 100,000 megohms and dielectric strength of 10,000 volts. The 10-mil tape offers protection against water, salt water, acids, alkalies, oil, and soil chemicals. Previously, Dressertape was available only in 2-in. size.

Dresser Manufacturing Div.

■

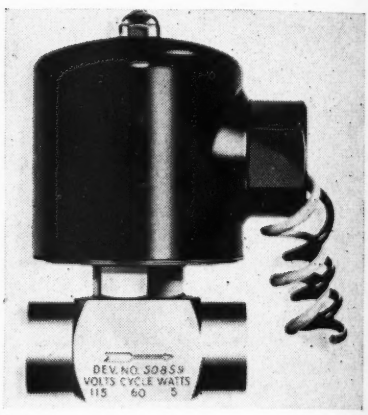


3 Thermostat Kit

Designed to facilitate installation of thermostats on gas water heaters, the Tankmaster kit is furnished with a Tankmaster thermostat, pilot burner and 36-in. thermocouple lead, 36-in. pilot line, and fittings together with instructions. The Titan Tankmaster control, with 100% safety gas shut-off pilot, features metal-to-metal valve and seat designed to prevent sticking, 61,500 Btu capacity, snap-action mechanism, accurate thermostatic control for maintaining desired operating temperature regardless of flow of gas, independent gas adjustments for main and pilot burners, non-critical temperature selector with markings every 10° F interval, and standard Baso gas thermocouple and power element.

Titan Valve & Manufacturing Co.

■



4 Solenoid Valve

The A-P Controls Corp. has produced a new solenoid valve, Model 67, designed for a wide range of industrial applications and available in two body styles with two types of needle and seat construction. Where positive seal-off is required, a synthetic resilient disc-type needle, seating against a stainless steel orifice is provided. Bubble-tight operation is assured under severe and critical conditions. For other applications, the valve is furnished with stainless steel needle, in combination with a high-strength, corrosion-resistant stainless steel valve seat, this design preventing "ovaling" and wire-drawing of the seat.

The valve, available as ⅜-in. female pipe or ½-in. OD tube sweat connections, can be used for air, oil, water, gasoline, alcohol, detergents, refrigerants, butane, propane, or other noncorrosive liquids and gases. Capacity on water is 78 gph; on refrigerant applications, 1 ton Freon 12. Working pressure up to 300 psi. Operating differential: liquid lift up to 130 psi, air and gases 250 psi, refrigerants 200 psi.

A-P Controls Corp.

Mail this Coupon for **NEW PRODUCTS INFORMATION**

COPIES OF NEW LITERATURE

GAS, 198 S. Alvarado St., Los Angeles 4, Calif.

10/52 Fill in numbers of items in which you are interested

No. ..... No. ..... No. ..... No. .....

No. ..... No. ..... No. ..... No. .....

NAME AND TITLE.....

FIRM'S NAME.....

ADDRESS.....

CITY.....ZONE.....STATE.....

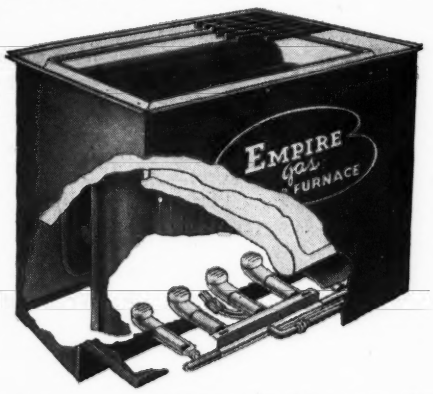
TELL THE *Gas Heat* STORY

WITH

EMPIRE

Gas

HEATING APPLIANCES

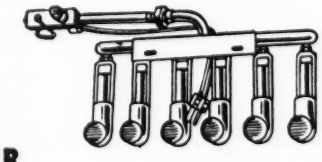


GAS FLOOR FURNACES

EXCLUSIVE WITH EMPIRE

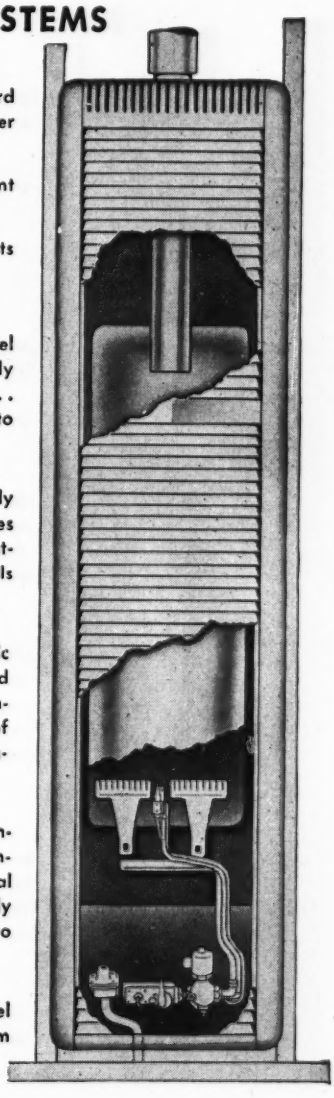
The **FAMED**

"Thriftmatic" *Gas* **BURNER**



EMPIRE *Gas* FLOOR FURNACES . . . will help you put over the *Gas* HEAT SALES STORY because . . . ONLY EMPIRE offers you ALL the EFFICIENCY — ECONOMY — DEPENDABILTY — SAFETY — and CAREFREE SERVICE demanded by YOUR CUSTOMERS.

RECESSED HEATING SYSTEMS



Designed to fit standard walls between 16" center studs.

Fully vented with 4" vent pipe.

Wall ventilator — prevents overheating of wall.

Non-marring baked enamel finish blends beautifully with any color scheme . . . safely cool . . . easy to keep clean.

Heating unit completely encased . . . prevents fires . . . eliminates overheating and marring of walls and wall finish.

New "T" type Thriftmatic burner . . . pilot and burner located inside combustion chamber out of critical lint area . . . minimum service.

Manual or Automatic controls . . . completely enclosed prevents accidental shutting off . . . easily removed by releasing two screws.

Raised from floor level . . . completely away from floor covering.

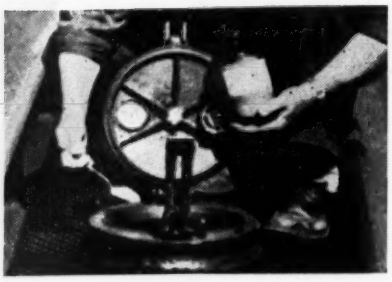
EMPIRE

SEE YOUR LOCAL EMPIRE REPRESENTATIVE OR WRITE DIRECT TO EMPIRE

STOVE COMPANY

BELLEVILLE, ILLINOIS

WORLD'S LARGEST MANUFACTURER OF *Gas* FLOOR FURNACES



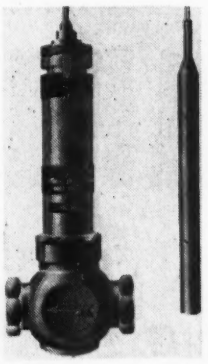
5 Rust Preventive

A volatile amine nitrite, known as VPI, and marketed by Shell Oil, is claimed to provide positive protection against rust without costly coating. The powder-like substance is also helping to reduce the cost of packaging metal parts, protecting them during storage and shipment, or between processing steps. Used in very small quantities, the product protects by giving off a vapor which is carried to all surfaces of the metal where it condenses to provide a thin film. VPI can be applied by placing it in crystal form in a package containing parts to be protected, by blowing the crystals into an area, or by dissolving it in a water or alcohol solution and spraying it on the parts or products to be protected. VPI has been effective in preventing corrosion, under high humidity, in precision engines, tools and dies, diesel engines and parts, sand blasted parts, continuous steel strip, steel rods and forgings, etc. It has also been used as a rust inhibitor in hydraulic fluids and in water soluble paints in general purpose industrial coating.

Shell Oil Co.

■

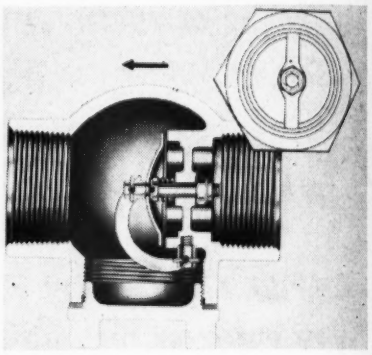
6 Temperature Regulator



Series V is a new line of self-operated temperature regulators of Farris Stacon, designed in either direct or reverse acting types for heating and cooling applications. They can be used to handle, through the valves, steam, liquids, gases, and all fluids not corrosive to brass. Operation is on the liquid expansion principle. Features include simple, field-replaceable thermostatic system, tight shutoff, positive and uniform throttling action, overload protection, dial adjustment, reduced maintenance, low-cost thermostatic system. Available in sizes ranging from ¼ in. to 4 in., Series V regulators will control temperatures between 25° F and 275° F, with a 50° range of adjustment. Their inlet pressure limit is 125 psig and inlet temperature limit is 450° F. The regulators have bronze bodies, renewable bronze or stainless steel seats and discs, and an 8-in. nickel plated copper capillary and nickel plated brass bulb standard.

Farris Stacon Corp.

■

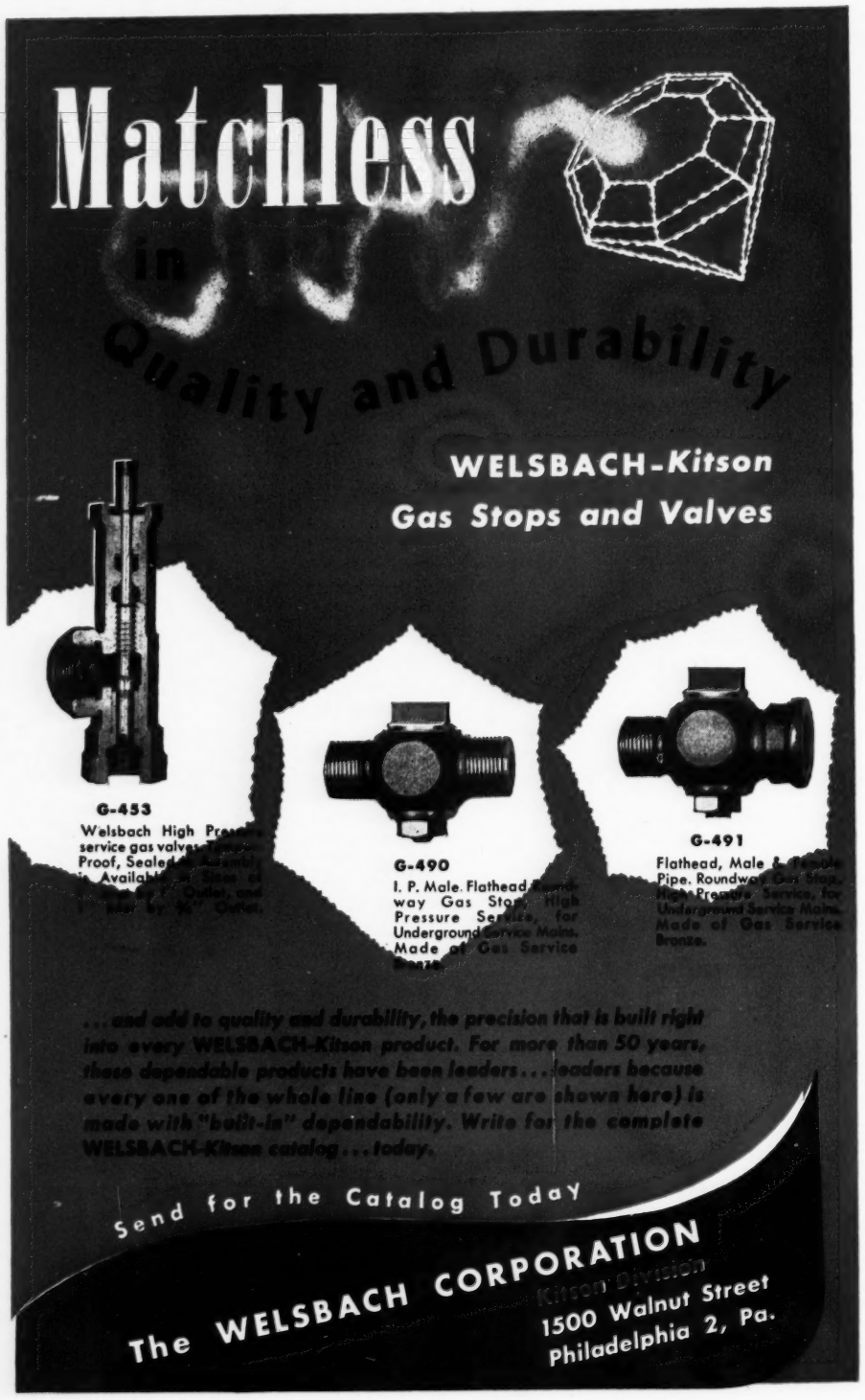


7 Check Valve

The patent to this horizontal, non-sticking, disc-type back-pressure check valve has been purchased by the Henry Flow Control Co. Suitable for application where gas and air are pre-mixed, the valve permits unrestricted gas flow at negligible pressure drop with the lightweight disc in full open position at pressures as low as 1-in. w.c. The valve features a spring-tensioned push-rod which holds the aluminum disc slightly off the valve seat except in case of reverse flow, insuring gas flow to maintain pilot lights and minimize the possibility of the disc sticking to the valve seat when oil, tar or other foreign materials are present or after the valve has been closed due to temporary back-pressure.

Either aluminum or stainless steel discs are available, depending on back-pressure requirements up to 125 psi.

Henry Flow Control Co.

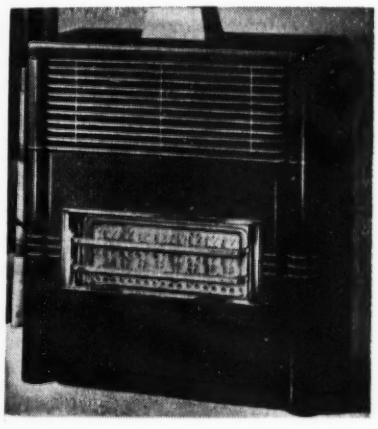

Matchless
in
Quality and Durability
WELSBACH-Kitson
Gas Stops and Valves
G-453
G-490
I. P. Male. Flathead
Underground Service Mains.
Made of Gas Service
G-491
Flathead, Male &
Pipe. Roundway Gas Stop,
Underground Service Mains.
Made of Gas Service
Bronze.
... and add to quality and durability, the precision that is built right into every WELSBACH-Kitson product. For more than 50 years, these dependable products have been leaders ... leaders because every one of the whole line (only a few are shown here) is made with "built-in" dependability. Write for the complete WELSBACH-Kitson catalog ... today.
Send for the Catalog Today
The WELSBACH CORPORATION
Kitson Division
1500 Walnut Street
Philadelphia 2, Pa.

8 Pilot Regulator

Departing from conventional designs, a new pilot regulator introduced by Detroit Regulator joins the top to the body by clamping rather than with screws. Known as Maxitrol RV-10-⅛", the regulator features a non-metallic seat. The regulator, slightly larger than a silver dollar in diameter, is designed solely for controlling pressures to gas pilots in furnaces, conversion burners, boilers, water heaters, and ranges. It is claimed that regulation is maintained even though inlet pressure rises to 1 psi at flow rates as low as ¼ cu ft per hour (200 Btu per hour natural gas).

The Detroit Regulator Co.

■



9 Room Heater

Pictured is one of the new Guard-O-Matic series featuring cool cabinet design in a vented, radiant-type circulating heater. Coolness of the top, sides, and underneath is effected by scientifically designed and located baffles. The baffles rapidly circulate the room air over the newly designed drawn-steel, oxide-finish combustion chambers and heat exchangers and force the heated air out of louvers located at the top front of the heater, thus achieving more even temperatures throughout the room and more accurate thermostat control. Dearborn has retained its Glo-brite radiants and High Crown burner in this series. All heaters in the line are equipped with 100% safety pilot and are available with a choice of three types of thermostats in addition to the Baso safety valve. The heaters are available in sizes of 30,000, 45,000, and 65,000-Btu capacities.

Dearborn Stove Co.

ANOTHER HAYS FIRST

STANDARD PACKAGES

OF IRON BODY

GAS SERVICE STOPS

FEMALE IRON PIPE ENDS

SIZE	¾"	1"	1¼"	1½"	2"
PIECES PER CARTON	25	20	15	10	6
CATALOG NUMBERS — APPROXIMATE GROSS WEIGHTS OF CARTONS					
7400	45	55	60	60	55
7405	45	55	60	60	55
7420	50	60	65	65	55
7425	50	60	65	65	55
7430	50	60	65	65	55
7435	50	60	65	65	55
7440	50	60	65	65	60
7445	50	60	65	65	60
7482	45	55	60	60	55
7484	45	55	60	60	55
7486	50	60	65	65	55
7488	50	60	65	65	55
7490	50	60	65	65	55
7492	50	60	65	65	55

THREADLESS COUPLING ENDS

SIZE	¾"	1"	1¼"	1½"	2"
PIECES	18	12	8	6	4
7500 to 7545	55	55	50	55	55

HAYS GAS SERVICE PRODUCTS

HAYS MANUFACTURING CO.

ERIE, PA.

"Yes, Any Time is a Good Time" to make a HEATH LEAKAGE CONTROL SURVEY

Milt Heath advises . . .

"Sign up NOW for a FALL and WINTER GAS LEAK LOCATION SURVEY"

Act *now* to obtain the reduced rates which apply to Fall and Winter type surveys. Heath Consultants, with their experience, know-how and special equipment, make complete and accurate leak location surveys in downtown areas and places where little or no vegetation exists. Heath locates leaks, classifies them as to size and importance, and furnishes detailed reports so that you reduce leakage and hazard to a minimum.

HEATH reports are highly rated by your legal and claims departments and by your insurance company. HEATH is the only nationally recognized leak location agency. Approximately 500 gas properties in some 40 states and in five provinces of Canada use Heath Leakage Control Surveys . . . and Heath clients renew their contracts year after year.

You too can save thousands of dollars annually, reduce hazards, and maintain a maximum SAFETY FACTOR. Decide *today* to have a Heath Leakage Control Survey on your property!

HEATH

You can't sell gas that leaked out!

LEAKAGE CONTROL SURVEYS

Write, Wire, or Phone for Complete Information

HEATH SURVEY CONSULTANTS, INC.

572 Washington Street, Wellesley 81, Massachusetts

Midwestern Office—Richmond, Michigan

TRADE LITERATURE

10 Linde-Fraenkl Description

"The Linde-Fraenkl Process—Low Cost Tonnage Oxygen Production" describes oxygen and other low temperature separation processes developed by Gesellschaft fuer Linde's Eismaschinen A.G. in a 24-page booklet from the Chemical Plants division of Blaw-Knox. Included in the booklet is a description and flow sheet of the Linde-Fraenkl process plus information on typical plant layouts. A discussion of investment, power, and operating costs is also included. A special feature of the booklet is a section covering thermodynamic data on air, oxygen, and nitrogen. Temperature-entropy curves and a comprehensive tabulation of the physical properties of oxygen and nitrogen are presented.

Chemical Plants Div., Blaw-Knox Co.

■

11 Small Pipe System Manual

A complete description of a new small pipe warm air system for use with all types of forced warm air heating systems is detailed in a booklet entitled "Muelleraire Small Pipe System Manual" just published by L. J. Mueller Furnace Co. The 20-page manual tells exactly what the Muelleraire system is and how it is to be used, giving information on the design of the system, installation procedure, and presenting tables for computing furnace and duct size. Mueller Climatrol winter air conditioning units and fittings to be used with the system are also described.

L. J. Mueller Furnace Co.

■

12 Regulator Bulletin

Design and operation features of Grove small volume air, gas, and liquid regulators are described and illustrated in a new 16-page bulletin. Included are detailed illustrations of all models, a discussion of operating principles and exclusive features, pressure service ratings, and capacity tables.

Grove Regulator Co.

■

13 Data Book and Catalog

The new 42-page 1952 edition of the Wheelco Data Book and Catalog contains up-to-date prices, application recommendations and pertinent information concerning instrument sensing units and associated accessories. Listings in the table of contents include resistance bulbs and wells, radiation detector, special thermocouples for plastic injection and extrusion machines, and a molten metal thermocouple for ferrous metals. Essential data pertaining to making, checking, selecting, and ordering thermocouples, wire sizes and resistances, and temperature-millivolt curves are also included.

Wheelco Instruments Division

■

14 Standards Bulletin

"End Preparation and Internal Machining for Machined Backing Rings for Butt Welds" is the title of a new standards bulletin from the Pipe Fabrication Institute. This revised standard, ES1-1952, meets present-day high pressure and high temper-

ature piping requirements and includes design changes that minimize the amount of weld metal required and the resultant shrinkage stresses in the weld. Five other PFI Standards are also available: Method of Dimensioning Welded Assemblies; Standard Practice, Shop Hydrostatic Testing of Fabricated Piping; Standard Practice Cleaning Fabricated Piping; and Built-Up Weld Metal Bosses.

Pipe Fabrication Institute

■

15 Heater Selection Guide

A 39-page illustrated catalog has been published by Black, Sivalls & Bryson to help in the selection of the most efficient heater for job requirements. A complete description is given of the BS&B line of 70 Series and Junior indirect heaters—uses, advantages, construction, capacities and specifications, dimensional drawings, and standard equipment. It shows how to select the right sized heater and flow coil for both gas and oil heating problems and works out sample problems of each.

Black, Sivalls & Bryson Inc.

■

16 Instruments Bulletin

"Instruments Accelerate Research," bulletin 15-14, has been revised to include items not covered in the previous edition and to bring up to date information on various analytical equipment. The 96-page bulletin now contains complete illustrations and description of the latest instrument equipment in the laboratory, analytical, and measurement fields.

Minneapolis-Honeywell Regulator Co.

■

17 Unit Heater Catalog

A new line of gas-fired unit heaters with welded steel heat exchangers from National Radiator is described and illustrated with cutaway and full view illustrations in a new catalog. Construction features are listed and rating dimensions and roughing-in data are shown in the new catalog bearing AIA File No. 30-C43. The new heaters, ranging in Btu input from 55,000 to 200,000 per hour, are designed for commercial and industrial applications.

National Radiator Co.

■

18 Engine Bulletin

Pictures, specifications, and descriptions of 5, 6, 7 and 8-cylinder, four-cycle engines are included in a new 8-page bulletin, S-550-B18A. Featured are totally enclosed gas engines designated as Type DDG, having a 15-in. bore by 17½-in. stroke in 50 and 60-cycle operation. Other spark ignition gas engines of the non-supercharged types are described briefly.

Worthington Corp.

■

19 Equipment Bulletin

Davey gasoline, diesel and electric-powered trailers; Auto-Air truck-mounted units, and industrial stationary machines are listed and illustrated in detail in a new 4-page bulletin. Complete mechanical specifications are included in a handy reference table.

Davey Compressor Co.

Announcing the NEW

RIDGID

Spiral Reamer

1/8" to 2"
RIDGID SPIRAL REAMER 2-S
RIDGID also makes No. 2 extra-long-taper pipe reamer — reams only burr, won't harm pipe or conduit.

NOW fast easy reaming with the new RIDGID 2-S Spiral

★ Reams pipe fast, easily and cleanly.

★ Makes quick work of enlarging conduit box outlets—cuts holes in sheet metal, smoothly, no chatter. Reams soil pipe.

★ Special design blades feed into metal at lightest pressure, cut it like wax.

★ Typical RIDGID tested design, fine craftsmanship and materials—extra long service for your money.

★ Buy the new 2-S spiral at your Supply House.

Reamer unit sold separately—fits your RIDGID OOR threader handle

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID

Work-Saver Pipe Tools

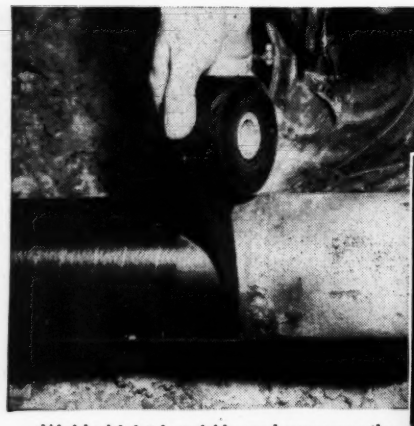
DRESSERTAPE* ... the name that means

QUALITY PROTECTION

... against corrosion

Gas men for over 50 years have known that any product bearing the Dresser name really does the job for which it is made. Before recommending Dressertape to you, *we* made sure it would work—give you the lasting protection you need. Now, we ask you to try it, with the same confidence you have in other Dresser products.

Dressertape can save plenty of expensive man-hours and cut your over-all costs on every job where pipe protection is required—because it's faster, simpler, more effective.



Welded joint is quickly and permanently protected by Dressertape without special surface preparation.

Complete, uniform coverage of irregular joints and fittings is easy with Dressertape. No gaps, voids or holidays.

LOOK AT THESE OUTSTANDING DRESSERTAPE FEATURES!

- Easy, clean to apply—sticks at a touch, no heating equipment required.
- Safe to use—no burns, no fumes.
- Conforms to irregular surfaces—especially over fittings on service lines.
- Immediate backfill—no waiting.
- Exceptional electrical properties—dielectric strength: 10,000 volts; insulation resistance: 100,000 megohms.
- Lasting protection against water, oil and soil chemicals—equal to or exceeding yard or mill-wrapped pipe.

* Dressertape is a trade-mark of Dresser Manufacturing Division

DRESSER® MANUFACTURING DIVISION
Bradford, Penna.
(One of the Dresser Industries)
Warehouses: Houston, Texas and South San Francisco, California

Gentlemen:

☐ Please send detailed information and literature about Dressertape.

☐ Please have your sales engineer call with Dressertape samples.

NAME _____ *TITLE* _____

COMPANY _____

STREET _____

CITY _____ *ZONE NO* _____ *STATE* _____

PEOPLE

A. W. Lundstrum

E. D. Bivens

The Ohio Fuel Gas Co., Columbus, has elected ALLAN W. LUNDSTRUM to the presidency of the company, succeeding the late William N. Grinstead. Succeeding Mr. Lundstrum as vice president and general manager is EVERETT D. BIVENS, former treasurer and since 1951 vice president and general manager of the United Fuel Gas Co., Charleston, W. Va. Prior to his association with Ohio Fuel, Mr. Lundstrum had served as director of research for the United Gas Pipe Line Co., Shreveport, La.; as a gas rate specialist and gas operating consultant with Ebasco Services Inc., New York; and as an assistant engineer with the Columbia Gas System Service Corp., Columbus. Mr. Bivens has been with Ohio Fuel since 1929 as assistant treasurer, treasurer, and a member of the board of directors.

HUGH H. CUTHRELL, president of the Brooklyn (N. Y.) Union Gas Co., was elected chairman of the board of directors, following the resignation of CLIFFORD E. PAIGE from that post. Mr. Paige will continue as a member of the board. Mr. Cuthrell, who succeeded Mr. Paige to the presidency of Brooklyn Union last year, has been with the company for 25 years. Mr. Paige has been in the gas industry since 1903 and with Brooklyn Union for 28 years. He became a director in 1932, chairman of the board in 1940, and served as president from 1935 until his resignation last year.

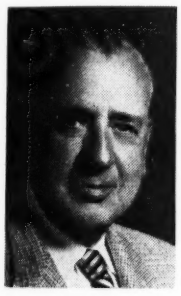
The Blaw-Knox Co. of Pittsburgh, Pa., has appointed GEORGE L. DIRKS to the post of general manager of its Blaw-Knox division at Blawnox, Pa. Mr. Dirks succeeds D. V. SHERLOCK, who returned from retirement to serve temporarily as acting general manager of the division. The chemical plants division of Blaw-Knox has expanded and reorganized its Tulsa, Okla. office into a complete operating unit to be known as the western headquarters. F. DRAKE PARKER, who assumed duties as manager of the unit on Sept. 1, will direct a staff which now includes some 100 engineers.

Announcement was made recently of the election of two new members to the board of directors of the Fluor Corp. Ltd., Los Angeles. FRANKLIN S. WADE, chairman of the board of directors of Southern California Gas Co., and DUDLEY E. BROWNE, comptroller of Lockheed Aircraft Corp., were appointed to fill the unexpired terms of F. M. STEPHENS, vice president of the company's manufactured products division, and

JOHN F. GARDNER, head of the project coordination department. Both Mr. Stephens and Mr. Gardner have submitted resignations. Mr. Wade is well known as a civic leader and for his activities in the gas industry, having joined the Los Angeles Gas & Electric Co., forerunner of SoCal, in 1905. He has held various positions with both Southern Counties and Southern California Gas Co. since that time. Mr. Browne, a certified public accountant, has been with Lockheed since 1937.

Recent PAD appointments include the following: HARRIS BATEMAN, Cities Service Oil Co., director of the material division; W. G. DONLEY, Standard Oil Co. of California, assistant director of the program division; JOE HALL, Phillips Petroleum Co., chief of the program division's domestic petroleum branch; and BYRON E. FRANCIS, Northern Natural Gas Co., special assistant to the director of the gas facilities division, a new position.

L. A. DIXON JR. has become vice president of the meter and valve division of Rockwell Manufacturing Co., Pittsburgh. In his new position he will coordinate the sale and manufacture of gas, water and oil meters, gas pressure regulators, and Nordstrom valves. Formerly assistant vice president of the division, Mr. Dixon served in the engineering department of the Pittsburgh-Dubois Co. and in 1944 was made executive vice president. When Rockwell acquired that company in 1947 he became general manager, later transferring to the parent company headquartered in Pittsburgh.

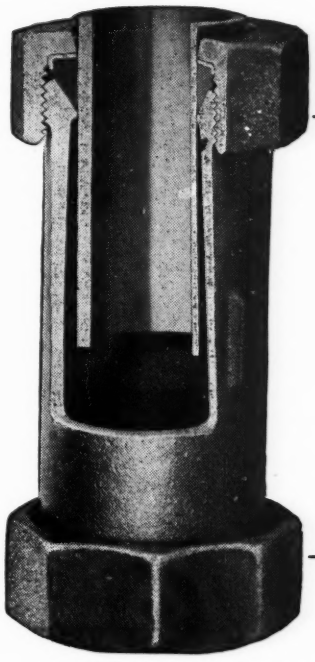


W. T. Bauer
Mission

L. A. Dixon
Rockwell

Appointment of WILLIAM T. BAUER as general sales manager of Mission Appliance Corp., Los Angeles, manufacturer of water heaters, space heaters, and floor furnaces, is announced by Paul M. Dollard, president. Mr. Bauer has been prominently identified with Mission Appliance since 1937 and with the manufacture and sale of water heaters and floor furnaces in California since 1923.

Changes in the sales organization of the home appliance division of Hamilton Manufacturing Co., Two Rivers, Wis., involve naming JOHN W. CHRISTENSEN to the position of manager-promotions. R. T. HOOPES will be manager-distributor sales. National and local dryer campaigns and promotions, national and co-op advertising, sales meetings, tools, training, publicity, product development, market reports, and sales territory alignment will be the responsibility of Mr. Christensen. Mr. Hoopes' responsibilities will cover internal organiza-



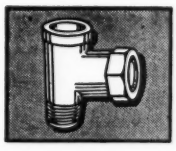
NORMAC

Couplings, Sleeves and Fittings

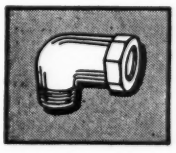
for maximum deflection, ease of "stabbing," complete confinement of the rubber!

So close are "Normac" rubbers confined at the gasket tip that possibility of flow is reduced almost to "nil." These couplings, sleeves and fittings . . . approved by gas utility men across the country for their time-saving features, ease of handling and dependable service . . . are available in a complete range of sizes. Made from air furnace malleable iron they provide greater wall thickness than pipe on which used.

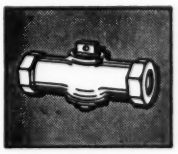
NORMAC COUPLINGS are made with 5" centers in all sizes. NORMAC SLEEVES are identical in design except that they are identical in design except that they are made with 10" centers. Nuts and gaskets are interchangeable.



Compression-End Service "Tee"—First fitting of this type ever produced with full coupling depth and special threads on male end to prevent dropping into old hand taps when used to replace standard threaded fittings.



Compression-End Service "Ell" — Extra depth makes it possible to "stab" pipe into stops and without measuring, pull back a safe distance to allow ultimate deflection eliminating possibility of strain against tap in main.



Compression-End Iron Body Brass Core Service Stopcocks—End the necessity of threading on the job plus the elimination of the threads themselves—combining all the advantages of NORMAC COUPLINGS and the best in stopcock design. 2½" coupling depth on each end.

Normac Brass Fittings Developed in 1939 for Use with Copper Tubing—Our complete line of brass fittings can be used either on new installations or where copper is run through old steel pipe in large or small openings. The center to end dimensions of NORMAC TEES correspond with old malleable iron fittings. This feature is extremely important in the use of these fittings in one foot openings where the tubing must line up with the steel which has been removed.

Write for the NORMAC CATALOG of Gas Distribution Equipment

NORTON-McMURRAY MFG. CO.
122 SOUTH MICHIGAN AVENUE - - - CHICAGO 3, ILLINOIS

Couplings • Meter Bars • Sleeves • Cocks • Bell Joint Clamps • Service Tees & Ells

tion, production schedules, allocations, shipments, credit, complaints, and services. Simultaneously with the preceding appointments, regional representative appointments were made. HICKS YOUNG, headquartering in New Orleans, will cover the southern states; EDWARD DODGE, Washington, D.C., will handle the Middle Atlantic states; and FRANK TSCHANNEL, Minneapolis, will cover the north central states.

Several promotions in division personnel have been announced by the Pittsburgh Group. THOMAS E. RIDGE is now assistant division superintendent of Division 2 with headquarters in Chester, W. Va. ROBERT S. BAUMAN, for eight years in the land section of the Pittsburgh general offices, has become assistant division superintendent of Division 5 with headquarters in Washington, Pa. EDWIN L. DAUGHERTY, in his 28th year of service with companies of the Columbia System, has been appointed personnel supervisor for Division 4, Hundred, W. Va.

Several appointments have been made by the L. J. Mueller Furnace Co., Milwaukee. They include: GEORGE O. WEBB as sales representative in the states of Washington and Oregon, with headquarters in Seattle. GEORGE M. HASE who has been recalled to the home office from his sales district covering North and South Dakota, Minnesota, and the northern portions of Wisconsin and Michigan, will be replaced by L. E. LEWIS, St. Paul, Minn. D. W. KARR has become a sales representative in a territory comprising North Carolina and parts of South Carolina, Virginia, and southern West Virginia.

G. O. Webb
Mueller

J. L. Haley
Niagara Mohawk

Retiring after 40 years in the gas and electric industries is JOHN L. HALEY, director and vice president of the Niagara Mohawk Power Corp., Albany, N. Y., and former division manager at Albany. His duties will be taken over by GUSTAV F. WATTERS of Syracuse, who is also a director and vice president of Niagara Mohawk.

LLOYD L. GRACE is the new representative of the Sprague Meter Co., Bridgeport, Conn. for Minnesota, Wisconsin, North Dakota, and South Dakota. He will work out of St. Peter, Minn., where he has been associated with the Minnesota Valley Natural Gas Co.

L. L. Grace
Sprague

H. Wiseman
Southern Heater

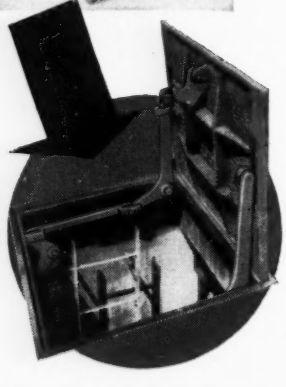
HARRY WISEMAN has joined Southern Heater Co. Inc., New Orleans, as sales promotion manager. He will specialize in promoting the sale of Ruud water heaters. Mr. Wiseman was manufacturer's representative for Ruud Manufacturing Co. and sales manager for American Airlines prior to his present affiliation.

A. P. ZIMMERMANN has joined the Carrier Corp., Syracuse, N. Y. as a senior project engineer in the centrifugal department. He will devote his time to development work for Carrier's line of air and gas compressors.

The Detroit-Michigan Stove Co. has named FRANK N. CONRAD as district sales manager for southern Ohio and northern Kentucky. Headquartering in Cincinnati, Mr. Conrad will handle both commercial and domestic lines of Detroit-Michigan. G. LOUIS SIGETY has become district sales manager in western Pennsylvania and all of West Virginia for Detroit-Michigan. He will headquarter in Pittsburgh.

WACHS Safety Vault Covers

for Valve, Meter, Transformer and District Governor Vaults



Features

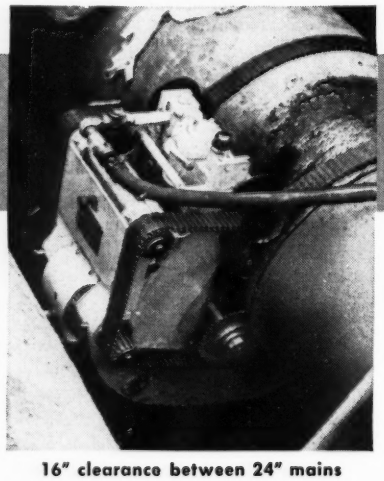
- One man can quickly raise cover with ease and without danger.
- Cover can not drop into vault or slam to cause injury or damage.
- Cover can be opened from the inside of the vault by one man—an added safety feature.
- Positive tamper proof lock that cannot be opened unless key is used.
- Open cover stands in upright position indicating that manhole is open.
- Unobstructed 30" square opening gives ample room for installation and servicing heavy equipment.
- Heavy duty for heavy traffic—cast iron frame and ribbed steel cover both machined for accurate fit to eliminate rattle.
- Moisture resistant, heavy cast steel levers and linkage with stainless steel pins in "Oilite" permanent oiled bronze bushings for long trouble-free service.
- Complete counterbalance structure protrudes less than 6' from the wall.

WACHS NATIONAL PIPE SAWS

Make Fast and Accurate Cuts on 10" to 48" Cast Iron and Steel Mains

Features

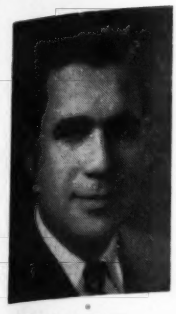
- Minimum Pipe Line down time.
- Cuts under water in flooded ditches.
- No broken pipe, milled cut.
- Thor Air-Powered, no flames near pipe.
- Set-up time about 15 minutes.
- Portable — weighs only 315 lbs. Two men can carry and set up unit.
- Small excavation—only 16" clearance needed.
- One machine cuts all pipe sizes from 10" to 48".
- Only two adjustments necessary for size changes.
- Cuts 24" pipe in 24 minutes — 36" pipe in 36 minutes, etc.



16" clearance between 24" mains

Write today for descriptive folder and engineering data on this new labor saving saw.

THE E. H. WACHS COMPANY
Manufacturers of Engines, Valves and Machinery since 1883
1525 NORTH DAYTON STREET · CHICAGO 22, ILLINOIS



E. L. Hall

For his contributions to the gas industry in the United States, Edwin L. Hall, director of the American Gas Assn. Testing Laboratories in Cleveland, will be awarded a Walton Clark Medal by the Frank Institute of the State of Pennsylvania. The medal is being presented "in consideration of his many contributions to the gas industry, in the improvement of old processes for gas manufacture, for the development of new processes for the production of valuable by-products by the pyrolysis of petroleum oils, and for the invention of a new and more efficient process for the production of high heating value gas as a substitute for natural gas." In addition to his work in the AGA Labs, Mr. Hall has worked with United Gas Improvement Co. as research engineer, the Syracuse Lighting Co., and the Manchester (N.H.) Gas Co.

The promotion of EDWIN M. DEMLOW to the position of appliance sales manager of Citizens Gas & Coke Utility, Indianapolis, Ind., has been announced. Mr. Demlow became a member of the firm's Quarter Century Club this year. He joined Citizens Gas as a house heating engineer, later became water heater sales supervisor and assistant appliance sales manager.

E. M. Demlow
Citizens Gas

E. Stuenckel
South Jersey

South Jersey Gas Co., Atlantic City, N. J. has appointed ELTON STUENCKEL advertising manager, replacing Harry Volk Jr., who resigned. Before joining South Jersey, Mr. Stuenckel had been advertising manager for a chain of furniture and appliance stores and account executive in an advertising agency.

GEORGE A. SCHILLER has been named assistant sales manager of the Dollinger Corp., Rochester, N. Y. He was formerly associated with the Dustex Corp., Buffalo.

New heads of the contract sales department of Perfection Stove Co., Cleveland, are H. C. ERHARD, manager, and H. E. THOMAS, assistant manager. Mr. Erhard joined Perfection in 1949 after the company purchased the domestic range assets of the Standard Gas Equipment Co., Baltimore. He had been with Standard Gas 33 years, the last five as vice president in charge of sales. Mr. Thomas was formerly a sales engineer in the contract department. He has been with Perfection 38 years.

ROBERT K. MUELLER has become general manager of Monsanto Chemical Co.'s plastics division, succeeding Vice President F. A. ABBIATI, who died in August. The division operates a headquarters at Springfield, Mass., another at Port Plastics, Ohio. Mr. Mueller has been assistant general manager since October 1950.

Newly appointed factory manager of Vulcan Rubber Products Inc., Brooklyn, N. Y., is W. P. FRISCO. From 1944 until his present appointment, Mr. Frisco was technical director of the St. Clair Rubber Co.

The post of senior engineer of the Peoples Gas Light & Coke Co., Chicago, has been assumed by WILLIAM M. MAHONEY, who has served recently as an engineer in the research and testing department. He started out with Peoples Gas in 1947 as a junior engineer in the engineering department.

WILLIAM H. DARRAH, formerly in the budget control department of the Iowa Power & Light Co., has become state budget director for Southern Union Gas Co., Dallas . . . After 17 years of service with Iroquois Gas Corp., Buffalo, HARRY J. WALZ has retired as general supervisor of stores and materials . . . In addition to offices as vice president, secretary, and director of the American Gas & Electric Service Co., W. J. ROSE has been elected a vice president of American Gas & Electric Co., the parent company.

ESPECIALLY FOR YOU!

VALVES, FITTINGS
and
FUNCTIONAL
ASSEMBLIES

Machined Forgings, Extrusions, Castings to exacting customer specifications. . . . For defense production or essential civilian requirements.

INVITATION
Let's get together at our space (No. 630) at the G.A.M.A. Exhibit, Atlantic City, Oct. 27-31.

DEFENSE—Producers and Suppliers of Ammunition Components for U. S. Army Ordnance. . . . Valves and Fittings for U. S. Navy, U. S. Army Air Force, U. S. Maritime Commission and other agencies demanding *Top Brass*, precision-made components.

CIVILIAN—Producers and Suppliers of Valves, Fittings and other components for the following industries: Air Conditioning • Automotive • Diesel Engines • Farm Equipment • Gas Appliances • Oil Refining and Heating • Plumbing • Refrigeration.

DETROIT BRASS & MALLEABLE CO.
SPECIALTIES DIVISION
DETROIT 9, MICHIGAN

AT YOUR SERVICE IN THE NATIONAL EMERGENCY

JAMES H. MARKS has been appointed general superintendent of distribution, Equitable Gas Co., Pittsburgh. He joined Equitable in 1935 as a cadet engineer in the operating manager's department, subsequently serving as district supervisor, foreman, and assistant superintendent in the distribution department; field man, planning and development department; and superintendent of the company's north side division of the distribution department.

Advancing from his position of general sales manager for A. O. Smith's Southwest district, J. H. BRINKER has been named assistant executive in charge of distribution at the company's Milwaukee offices. Coordination of matters related to distribution of company products, general management service and direction to the manufacturing divisions in the distribution and marketing fields, supervision of advertising and sales promotion, exhibits, displays, and market analysis will be among his responsibilities.

THOMAS A. COLLINS has been elected by the board of directors of Glass Fibers Inc. to fill the newly created post of executive vice president. Mr. Collins has spent his entire business career with various companies in the glass and glass fiber industry, among them Owens-Corning Fiberglas Corp. and Owens-Illinois, where he recently resigned as general manager of the Kaylo Div. He will headquarter at Glass Fibers' home office in Toledo.

For Many Pipeline Jobs, *Only* the Sherman *Power* Digger is Practical

The Sherman Power Digger operates with precise, fingertip control. It swings at a 140° arc with a reach of 10 ft. behind the tractor and 8 ft. below grade.

Get the most out of the pipeline digging equipment you now have by keeping it on your big pipe-laying work.

On maintenance jobs where giant equipment and manual labor are both impractical, use a Sherman Hydraulic Power Digger. It uncovers pipeline quickly—at low cost. You can buy the digger plus the light, rubber-tired tractor to which it is fitted for less than the cost of many automobiles.

For complete information on how the Sherman will cut your pipeline maintenance costs and release your other equipment for big jobs, write today for free descriptive literature J2.

See us at the A G A Convention, at Atlantic City, October 27-31, Booths 808 & 809.

Designed, Engineered and Manufactured Jointly by
SHERMAN PRODUCTS, Inc.
Royal Oak, Michigan
WAIN-ROY CORPORATION
Hubbardston, Mass.

•

Patent No. 2,303,825
Other patents pending

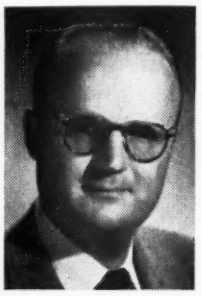
Sherman
PRODUCTS, INC.
ROYAL OAK, MICHIGAN
Sherman SP Products

The board of directors of United States Steel Corp. recently elected ROGER M. BLOUGH a director and a member of the finance committee. Mr. Blough became vice chairman of the board in May, at which time he was executive vice president, law, and secretary of U. S. Steel Co. Previously he served as general solicitor.

American Car & Foundry Co., New York, has elected JAMES F. CLARK as vice president in charge of finance and JOHN F. BURDITT as treasurer. Mr. Clark was formerly vice president and treasurer and Mr. Burditt has been assistant treasurer for a number of years.

E. C. KOLLOCK has retired from the Atlanta (Ga.) Gas Light Co. after 42 years with the company. He served as chief engineer of the company from 1930 to 1951 and since then as consulting engineer. He played an important part in designing the facilities for and planning the advent of natural gas into Georgia and helped plan the expansion of natural gas facilities at Port Arthur, Texas.

CECIL B. OAKLEY has been appointed sales manager of Temco Inc., Nashville, Tenn. He has been with the company for six years as field representative. He will be assisted by J. H. HOLLIDAY.



C. B. Oakley
Temco

M. W. Battersby
Murray Corp.

The Murray Corp. of America has named MARK W. BATTERSBY to the post of west coast regional sales manager of the home appliance division. He was formerly Pacific Northwest district sales manager. From his headquarters in San Francisco he will supervise sales in Washington, Oregon, California, Idaho, and Nevada.

HAROLD ROSE has been promoted to superintendent of the Gas Service Co. in Kansas City, Kan. He started out with the company in 1926 as a fitter's helper, advanced to general service work, and more recently served as shop foreman and assistant superintendent.

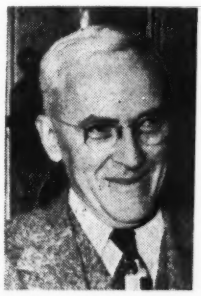
EDWARD E. KRIEGE, sales engineer, has been appointed to the Ohio territory by the Milwaukee (Wis.) Gas Specialty Co. Mr. Kriege, with headquarters in Cleveland, succeeds DON R. WEIDENFELLER, who has been transferred to the Milwaukee office.

BILL WILLIAMS has been placed in charge of sales training for all sales divisions of Black, Sivalls & Bryson Inc., Kansas City, Mo. He will headquarter in the company's Kansas City offices.

Obituaries

W. R. Ray

WILLIAM R. RAY, a pioneer in the controls industry, died at his Los Angeles home in August. Mr. Ray, 73, was chairman of the board of directors of the General Controls Co., Glendale, Calif. at the time of his death. The original model of an oil burner invented by Mr. Ray which, for the first time, made it economically possible to use oil for heating and power purposes, is on exhibition at the Smithsonian Institute. Following the sale of his company, the Ray Oil Burner Co., in 1929, he assisted his sons in forming General Controls, which at present has 31 branches throughout the United States.



H. F. Mitchell

HARRY F. MITCHELL, 67, treasurer of Union Gas System Inc., Independence, Kan. died unexpectedly in Kansas City on Sept. 1 from post-surgical complications. He had been an officer and director of Union Gas for more than 30 years and was one of the oldest employees in point of service. He was also an officer of Midland Industries Inc. and Gibralter Finance Corp. Born in Franklin, Pa. in 1885, Mr. Mitchell joined his company's predecessor, Union Gas Co., in Independence in 1916.

CHARLES E. TRINKNER, 61, died of a heart attack recently. At the time of his death, Mr. Trinkner was superintendent of distribution, street department, Southern California Gas Co., Los Angeles. He had held that position since 1937, when the Los Angeles Gas & Electric Co. became SoCal. He joined Los Angeles Gas in 1914 as a meter reader, served as clerk, investigation man, assistant foreman, and foreman.

LEWIS A. ROBERTSON, vice president of Zenith Gas System Inc., Woodward, Okla. died recently of a heart ailment. Born in Galveston, Texas, Mr. Robertson moved from Houston, Texas to Woodward in 1933. He was in charge of the Woodward office under W. L. Woodward, president of the company.

ROBERT J. HORN, gas operating manager for the Central Hudson Gas & Electric Corp., died in Poughkeepsie, N. Y. late in August. Mr. Horn, 57, was a member of the AGA, the American Society of Mechanical Engineers, and the American Chemical Society.

HARRISON SMITH, 71, oil and gas engineer and a partner in the firm of Sanderson & Porter, died in Greenwich, Conn. recently. A specialist in oil and gas refining projects, Mr. Smith was a member of the American Gas Assn., the Rensselaer Society of Engineers, and the American Society of Civil Engineers.

GEORGE T. MACBETH, 73, formerly chief gas engineer for the Westchester Lighting Corp. for 28 years, died in Yonkers, N. Y. on Sept. 5. Born in Greenville, S. C., Mr. Macbeth was graduated from Furman university and from Temple university.

LELAND TALIAFERRO, associate general solicitor in the law department of Public Service Electric & Gas Co., Newark, N. J. died recently following a long illness. He was 55. He served the company as assistant general attorney, assistant general solicitor, and assistant general counsel.

HENRY P. CUMMINGS, 80, retired division superintendent of the Pittsburgh group, died in August after an illness of four years. He was the superintendent of Division 5 with headquarters in Washington, Pa. He retired in 1946 with a service record of 53 years.

OMER A. WILSON, secretary-treasurer of the Indiana Gas & Chemical Corp., and the Terre Haute Gas Corp., died in August in Indianapolis. He was 67.

STANLEY G. STEWART, 70, director of Union Gas System Inc. died in August. He was also an officer in the Consolidated Cement Corp. and the Continental Building Corp.

LP-GAS FOR
STAND-BY PLANTS,
PEAK-LOAD
DEMANDS
Industrial Plants, Cities:
When dependability of LP-Gas supply is the important factor in choosing the supplier, look to Anchor. Anchor has the tank car fleet, the transportation knowledge and the sources to take care of your needs. Anchor's offices are located to give nation-wide service. So, before making contracts, Call Anchor First.
ANCHOR
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SALES OFFICES: DES MOINES • OMAHA
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ASSOCIATIONS

PCGA Convention Attracts Over 900 Delegates

Delegates to the 59th annual PCGA convention assembled in Los Angeles last month for what was the largest, and probably the hottest, convention in PCGA history. Nine hundred and fifty-three delegates, including wives, sweltered while temperatures reached into the 90's as the Sept. 3-5 meeting got under way at the Ambassador hotel, and shirt sleeves were the order of the day at most of the sessions.

The meeting's emphasis was definitely on sales. Nine out of 13 speakers were concerned directly or indirectly with that subject.

"Before we can move ahead, the industry must become more secure in holding present load and improving our position competitively as to new business," said O. R. Doerr, PG&E sales vp, in a talk on "The Market, Its Magnitude and Needs." Natural gas consumption in California may triple by 1970, he predicted. Gas heating must be maintained at its present level and the lead held in gas ranges and water heaters while appliances such as refrigerators, laundry dryers, and air conditioners which are not yet near the saturation point must be pushed hard to expand the gas market.

A portion of the PCGA convention goers at a banquet in the Cocoanut Grove.

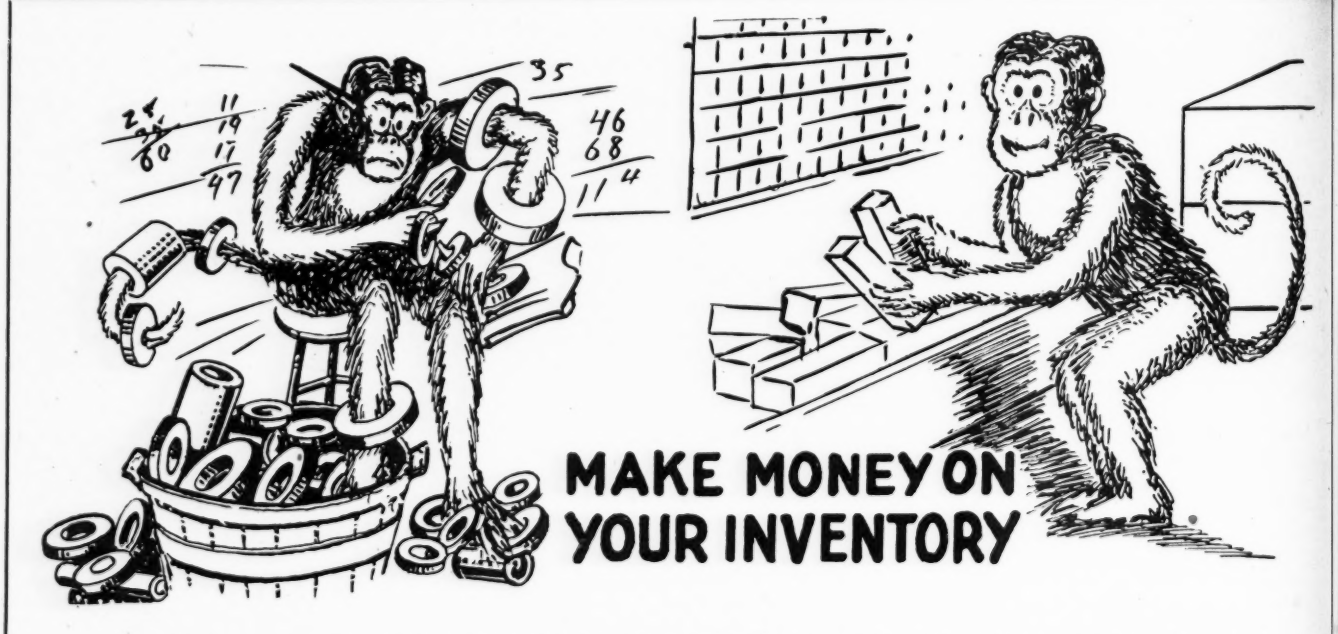
Louis Ruthenburg, president of GAMA and chairman of the board of Servel Inc., outlined the growth of the gas industry and pictured it as being on the verge of a "golden age." Since 1942, the number of residential gas customers has increased 54.9%, he said, and the per capita use of gas in this country has jumped 287% since 1935 while electric power use has increased only 176%. "Basic conditions in the gas industry still afford opportunity unlimited for expanding of the residential gas market," he concluded.

John Fistere of *Fortune* magazine stressed the increasing importance of salesmanship to business in general, as did Robert Bell, Packard-Bell vp, who outlined the use-the-user sales plan in use by his company. This plan, which uses satisfied customers to build sales, has proven very successful, he said, and is partly an answer to the ruinous price-selling theory which has become so widespread lately.

"Unless over-all earnings meet the test of adequacy and the level of class charges reasonably conforms with class costs and the competitive value of the service, I believe it is almost impossible to avoid long term deterioration in a utility's financial condition and a consequent impairment of its ability to render good service to the public," Walter Herrman, SoCal vp, maintained in a paper on "What to Look for in Gas Rates and Rate Structures." Although every utility rate problem is an individual problem, "the most nearly perfect rate for combination residential service would be one that differentiated specifically between customers on the basis of the number of appliances used," he said.

"Is Television Today's House-to-House Salesman?" asked Ruddick Lawrence of the National Broadcasting Co. in a slide talk showing the anticipated growth of TV and its effectiveness as a sales medium, particularly for such items as appliances.

Rensis Likert, director of the University of Michigan Institute for Social Research, gave some of the findings of his organization on the relationship of various kinds of management to employee production. Among other things, the institute found that employees produce more when there is less supervision by the foreman than they do



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when there is too much supervision, and that production increases when management is more employee-minded than production-minded.

Also on the program were Frank Smith, president of the Houston Natural Gas Corp., who spoke on "Begonias and Business"; George S. Coates, Customers' Department manager for Southern Counties Gas Co., on "Let's Get Rid of the Unreasonable Customer"; W. H. Weber, customer service manager of Brooklyn Union Gas Co., on "Service Sells"; and Dr. William Alexander, Republican National chaplain, on "Our Moral Needs." Elsewhere in this issue will be found the complete text of the talk by Mr. Herrman.

Thirty-four men were honored by becoming charter members of the Forty-Niner Club, a group organized to give recognition, on a point basis, for past contributions to association activities.

Outgoing PCGA president W. M. Jacobs (right) of SoCal and Frank Wright, Southern Counties, have words with Mr. Gas Flame.

PCGA officers nominated and elected for the following year included J. S. Moulton, vice president of PG&E, who succeeded W. M. Jacobs as president; W. C. Mainwaring of British Columbia Electric Co., vice president; and Harry McGann, PG&E, treasurer.

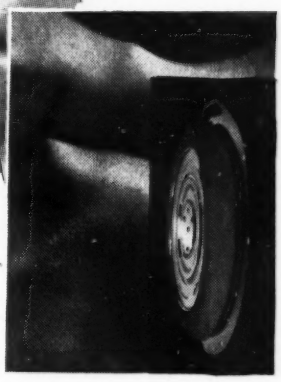
One new director was elected, A. R. Bailey of Coast Counties Gas & Electric Co. Directors re-elected were W. J. Bailey Jr. of Affiliated Gas Equipment; C. H. Gueffroy of Portland Gas & Coke Co.; F. B. Wright of Southern Counties Gas Co.; and R. T. Richards of Arizona Public Service Co. New section chairmen are W. J. Bailey Jr. (manufacturers' section); L. C. Olpin, Mountain Fuel Supply Co. (accounting section); Charles F. Briscoe, Southern Counties Gas Co. (technical section); and R. D. MacMahon, SoCal (sales section).

PCGA awards included the Basford Trophy to the technical section, chairmanned by J. R. Rensch of Coast Counties; a gold medal to R. M. Crosby, SoCal, for his work in the design, production, and preparation of display material for promotions; committee awards to the transmission procedures committee of the technical section (W. H. Krammes, SoCal, chairman) for its study of safety procedures in repairs to pipelines and to the committee on destruction of records in the accounting section (E. J. Wright, San Diego Gas & Electric, chairman) for its recommendations on destroying records; committee award with a gold medal to J. L. Hall, SoCal, chairman of the federal housing and veterans administration regulations committee for recommending adequate sizing of water heaters going into new buildings; honorable mention to Frank N. Seitz, Southern Counties, for organizing a road show to carry a sales message to manufactured and L.P. gasmen in Washington and Oregon; to Alan Kinkead, William Wallace Co., for the paper, "Let's Look at Venting"; to C. J. Tateosian and R. W. Brooks, PG&E, for the paper, "Development of Compressor Operating Charts for Gas Compressor Stations"; and to Dr. Robert T. Knapp, Cal Tech, for the paper, "Flood Characteristics of Alluvial Streams Important to Pipeline Crossing."

Oil Show Space at Premium

With eight months still to go before the 1953 International Petroleum Exposition opens in Tulsa, space is already at a premium and a record number of exhibitors is assured, according to General Manager William B. Way.

In mid-September 628 space contracts had already been signed, as compared with the last (1948) show when the final total was 574. The management has already allotted the first additional space section obtained and is negotiating for a second. Between 150 and 250 more exhibitors than were represented at the 1948 show are expected to eventually sign up for the May show.



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Utility company graduates of the first summer refresher course at the Institute of Gas Technology included (front row) H. M. Boyer, SoCal; J. F. Schuldt, Peoples Gas Light; R. E. Bayne, Hope Natural; J. D. Parent, dean; E. S. Pettyjohn, director; W. G. Hulbert and C. E. Campbell, East Ohio; E. A. Skibinski, Rochester. Second row: W. P. Blake, Minneapolis Gas; J. M. Atkinson, Peoples Gas Light; E. V. Fisher, Ford, Bacon & Davis; R. V. Burnette, Rockwell; E. B. Hedges, Michigan Gas Storage; C. F. Boekell, Hope; P. S. Magruder Jr., SoCal; H. G. Kaess, Minneapolis. Third row: E. C. Rowan, Ford, Bacon & Davis; B. L. Gregorowicz, Inland Steel; F. L. Bennett, Seattle Gas; J. M. Phillips, Southern Natural; D. T. Strieff, PSCo. of Northern Illinois; R. A. Johnson, Rockwell; O. G. Bryant, Houston Natural; R. T. Miller, Portland; J. F. Gary, Seattle.

First Summer Course Ends

The first of its six-weeks summer refresher courses in gas engineering was completed late in August when the Institute of Gas Technology, Chicago, presented 23 certificates of accomplishment to gas company employees in an informal graduation ceremony.

In courses under the general headings of natural gas and transmission and distribution, those in attendance were brought up to date on current problems and practices of the industry, current research, and present-day methods of measurement and computation. Instruction was given at the graduate level.

Group Begins Studies of Smaller Companies' Needs

At its initial meeting held August 26 at AGA's New York headquarters, a special subcommittee spearheading activities of the newly activated committee on special problems of smaller gas companies launched into a study of competitive practices, advertising, public relations and promotion.

The session followed closely the first meeting of the entire committee, a one-day affair attended by 13 officials of small companies selling gas exclusively.

Recommendations on numerous problems made by the subcommittee were on the agenda for a second meeting of the larger group late in the month. Among the topics covered were membership in PAR, modernization of small company quarters, aggressive gas appliance merchandising, business financing, harmful competitive practices, gas mains extension practices, including the use of bottled gas in fringe territories.

Betterment of Commercial Cooking Equipment Studied

Desirable improvements in field operation and performance of commercial cooking equipment were extensively discussed at a two-day meeting held Sept. 8-9 at the AGA Laboratories in Cleveland.

The significance of tests on commercial cooking equipment being conducted cooperatively by the National Restaurant Assn. and the quartermaster board at Camp Lee was outlined by David Chase of the quartermas-

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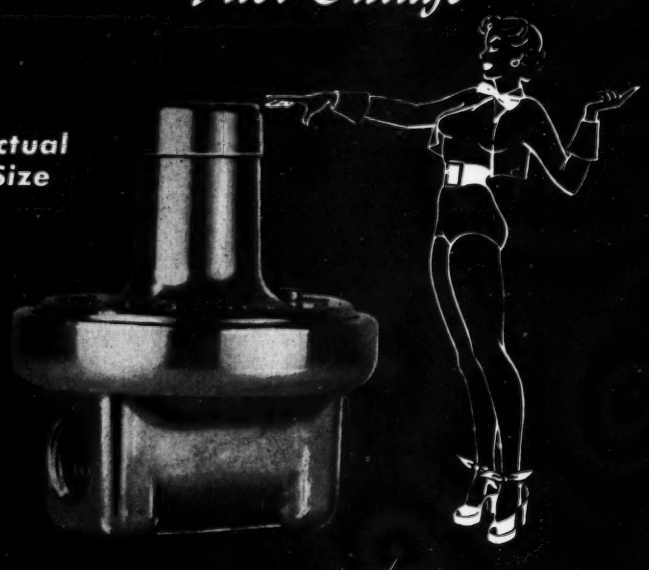

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ter board. Research projects on commercial cooking equipment in progress by the American Gas Assn. were discussed by W. B. Kirk, Laboratories chief research engineer. R. L. Stone, research engineer, covered the application trends of research findings on deep fat fryers (see *GAS*, August, p. 36). He also outlined a proposed fryer output performance test using a water coil and potato frying procedure.

Other phases of the broad program to assist equipment manufacturers to upgrade products were discussed during the program, including problems in mass feeding and performance requirements of restaurant owners and testing and servicing requirements.

In attendance were representatives of the Army, air force, food equipment industry, gas utilities, control manufacturers, and the AGA. George L. Anderson of the office of the quartermaster general and Paul P. Logan of the National Restaurant Assn. presided.

PUAA Begins Round Robin Of Regional Conferences

The Public Utilities Advertising Assn., whose 325 active members represent virtually every major gas and electric utility company in the United States and Canada, launches its annual series of regional meetings this month.

Representatives of companies in Region 4 will convene at French Lick Springs, Ind., Oct. 7-8 for two days of discussion of association and utility company problems. Region 3 will meet in Cleveland Oct. 23.

Other sessions are scheduled as follows:

Region 7, Nov. 13-14, Cedar Rapids, Iowa.

Region 2, Dec. 4-5, Atlantic City.

Region 1, February, Boston (date to be selected).

Region 9, February, Yosemite or Pebble Beach, Calif.

Region 8, Feb. 2-3, locale to be selected.

Region 5, March 12-13, Richmond, Va.

The PUAA, a department of the Advertising Federation of America, is headed this year by Paul L. Penfield of Detroit Edison.

318 Enroll in Gas School

With attendance hitting a new high of 318, the 29th annual Mid-West Gas School & Conference convened Sept. 11-12 at Iowa State College in Ames to hear top lecturers in the fields of gas production, distribution, utilization, meters and meter repair, and servicing.

General sessions covered safety, high pressure service installations, gas venting, and galvanic electrolysis control. Two of the most popular features were a display of equipment and devices used in gas operations and a field demonstration of distribution construction equipment.

Association Newsnotes

The 11th international Heating, Ventilating and Air Conditioning Exposition will be held in conjunction with the 59th annual meeting of the American Society of Heating & Ventilating Engineers when the association convenes in Chicago Jan. 26-29. This will be the largest heating, ventilating and air conditioning exposition ever held, with over 300 exhibitors participating, and the society, which anticipates a meeting of record proportions, will have space in the show featuring several of its current research projects.

Applied research will be the general theme of the second annual corrosion conference of the western region of the National Assn. of Corrosion Engineers, scheduled for Nov. 20-21 at the Biltmore hotel in Los Angeles.

On Oct. 6, the first school designed specifically for the study of low temperature fractional analysis of petroleum gases and liquids is scheduled to open at Oklahoma university, Norman, under sponsorship of the Natural Gasoline Assn. of America. Taking as its students partly trained operators from natural gasoline plants and laboratories who need additional instruction on the finer points of analysis, the school will consist of a series of 3-week courses, with 10 enrollees per course, during a 10-month period. Reservations for the first year are already filled.

Formation of a corporate secretaries committee, conceived as a means of promoting meetings and activities of specialized interest to corporate secretaries of member gas utilities, has been authorized by AGA's executive board. Heading up the group, which will sponsor a luncheon meeting at the AGA convention in Atlantic City this month, is Dale Parker, secretary of the Columbia Gas System.

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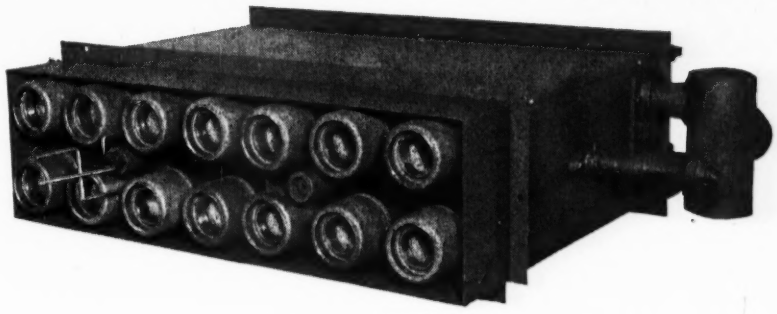

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NEWS

Regulations

1953 Expansion Goal Approved By Government

On Sept. 17 the government approved a gas utility expansion goal for 1953 which would require three times the amount of steel pipe allowed for the industry this year.

Whether the 1953 goal of 7200 miles of large pipe and 17,700 miles of small pipe is met or not will depend on the availability of steel. Government sources in Washington believe that insufficient steel will be available to meet this figure which was recommended by the PAD and approved by the DPA. In contrast to the 700,000 tons of steel made available in 1952 for gas expansion projects, the new goal would take 2,198,000 DPA said.

At the same time, DPA released PAD forecasts indicating a 10% increase in sales of all types of gas next year over the 1952 figure of 56,596 million therms; a 17% increase is expected in 1954 and by 1955 sales will be 23% over 1952.

An exact statistical basis is not available for comparing the 1953 goal of 25,900 additional miles of gas pipeline with previous years. Industry figures show an increase of 19,100 miles in utility gas main, from 387,500 in 1950 to 406,600 in 1951.

PAD Order #2 Revised; Gas Restrictions Eased

A recent revision of the much-discussed PAD Order No. 2 has resulted in the easing of restrictions on deliveries of natural gas for space heating and large volume use.

Existing limitations have also been removed on natural gas deliveries in areas of Michigan not served with gas wholly or partly by the Michigan-Wisconsin Pipe Line Co. PAD said this change was made because it found the supply of gas available to Panhandle Eastern Pipe Line Co., serving several southeastern Michigan cities, was adequate to meet expected demands.

PAD amendments to Order No. 2: (1) Require reports on peak-day and annual demand only from sellers specifically notified by PAD; (2) provide that exemptions from or modifications of the limitation provisions of the order may be effective for a specified period instead of only 12 months; (3) indefinitely extend the provision permitting gas companies to take on new space-heating customers up to 1% of their total number of customers during the 1-year period following Aug. 22, 1951, with the proviso that any modifications of the order by PAD to permit any company to take on a specified number of such customers shall have the effect of superseding the 1% provision; (4) allow companies which have converted to natural gas since July 1, 1951 to add space-heating customers at an annual rate of 5% or a total number not in excess of 10% of the number of gas customers served at the time of conversion. This change permits companies to take a period longer than two years to acquire house-heating customers up to 10% of their total customers.

According to PAD, the amendments are based largely on recommendations by a committee of the gas industry advisory council and by representatives of the public utility commissions of the 13 states (and the District of Columbia) in which the order is effective.

Among companies affected by the order are the following: Pavilion Natural Gas Co., Geneseo, N. Y., 250 new customers; Republic Light, Heat & Power Co., Buffalo, N. Y., 967 customers; Rochester (N. Y.) Gas & Electric Corp., 2200 gas heating units; New Jersey Natural Gas Co., Asbury Park, N. J., 5000 new customers; Citizens Gas Fuel Co., Adrian, Mich., 200 new customers with an extension until August 1953 of the previous authorization to extend service to 222 customers in a 12-month period ending Dec. 5, 1952; Southeastern Michigan Gas Co., Port Huron, extension until Feb. 28, 1953 of the period in which 900 new customers may be added.

Columbia Gas Subsidiaries Ask Return of Restrictions

Following failure of United Fuel Gas Co., Charleston, W. Va., and Amere Gas Utilities Co., Beckley, W. Va., in their appeal to the public service commission to have certain restrictions on the use of their product re-imposed, two additional companies in the Columbia Gas System have gone to the state supreme court for help.

United Fuel, Amere, Manufacturers Light & Heat Co., and the Cumberland & Allegheny Gas Co. claim that the PSC lifted restrictions on new customers and on the use of gas for space heating without giving the utilities an opportunity to present evidence in support of continuing the restrictions.

Regulatory Newsnotes

According to Joseph O'Mahoney of Wyoming, chairman of the Senate Interior Committee, hearings will be resumed in November or December on the committee's study to develop a national fuels policy. In making the announcement, O'Mahoney said that ". . . it is imperative . . . to have a clear, specific, and definite fuels policy" and that the United States "cannot permit itself to become dependent on foreign sources of supply of fuels. We must be prepared to use all kinds of fuel—petroleum, coal, natural gas, synthetic liquid fuel, and water power."

A special task force has been organized to carry on a study of the nation's material resources, with William H. Stead, director of the Office of Natural Resources of the National Security Resources Board, directing the group. Members include representatives of 25 major departments and agencies of the federal government who will review the recommendations made by the Materials Policy Commission and recommend ways of putting them into effect.

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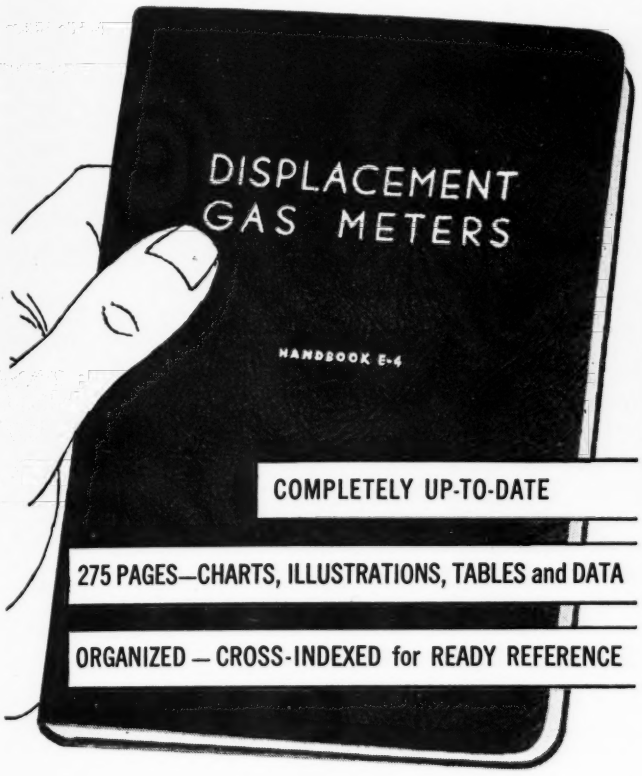

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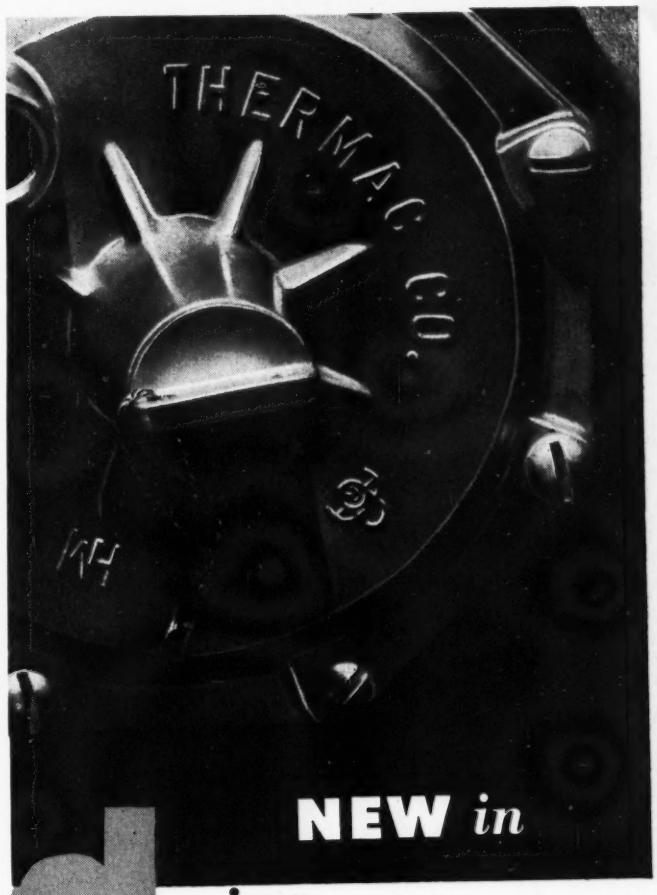

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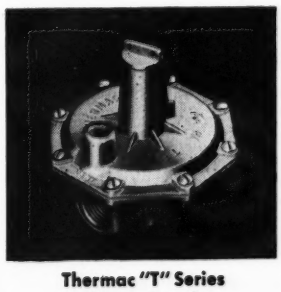

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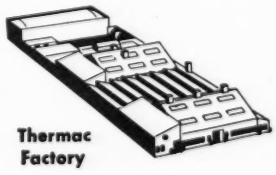

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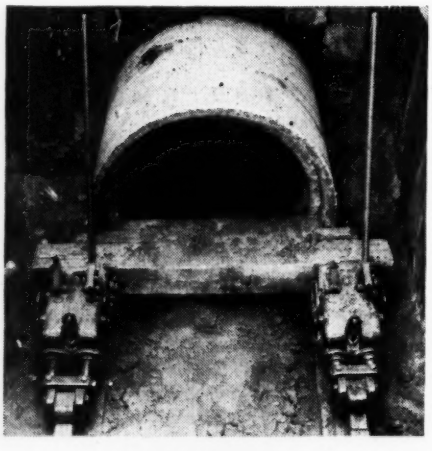

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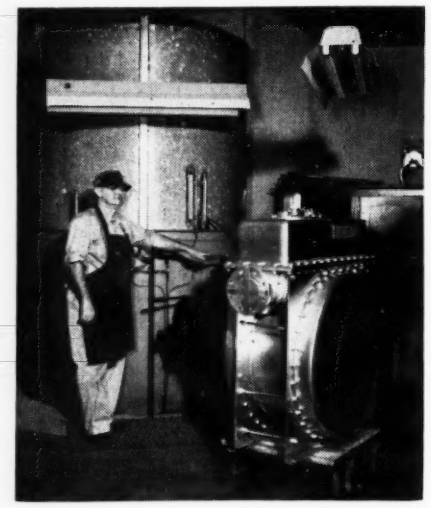
New Construction

Southern Counties Opens Completely Unified Plant

A week-end open house was held on Sept. 19-21 by the Southern Counties Gas Co. in celebration of the opening of its new plant site. The company has developed its 13-acre Triggs street base in Los Angeles into what is one of the most competently planned utility company installations of its kind.

Planning years ahead to keep pace with the growth of the territories it serves, Southern Counties purchased the land for the new base in 1945. At that time facilities were located at a number of widely separated points on what was for most part leased properties.



All types of meters from the small domestic to the mammoth industrial displacement meter pictured here, over 63,000 annually, are processed for the entire Southern Counties system at the general meter shop at the Triggs street base.

Now located at the unified center is a 4-story office building occupied by the engineering, accounting, personnel, claims, home service, and customer service departments, formerly located in downtown Los Angeles. The central warehouse and connected office building of the purchases and stores department, the general meter shop, general repair shop, central offices and garages of the transportation department, and the 4-acre pipeyard with its facilities for the protective coating and wrapping of pipe are now all located in the Triggs street plant in east Los Angeles. The company's total investment in land, buildings, and equipment is $3 million.

Development of the base began in 1946 with construction of the purchases and stores office building and the central warehouse. This was followed by the pipeyard facilities in 1947; in 1948 the group of shop buildings was completed; and in August 1951 construction of the office commenced. The building was completed in May of this year and the move was completed in August.

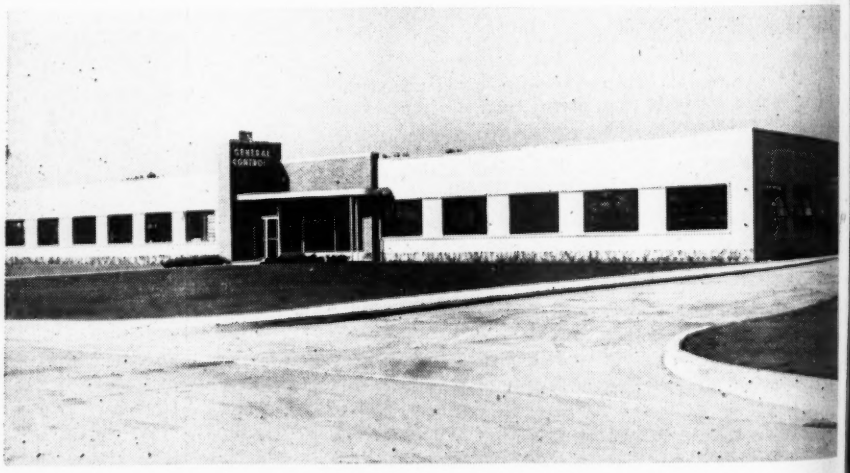
Additional departments located at the new plant include the central tool depot, the chemical laboratory for conducting analytical tests, and employee training facilities including customer service training classroom, home service planning kitchen, and the welding school.

General Controls Dedicates New Illinois Plant

In a move aimed at strengthening its midwestern and eastern market operations, General Controls Co. of Glendale, Calif. has opened its new plant at Skokie, Ill., just 10 miles north of Chicago.

The opening, held on Sept. 29, was highlighted by a luncheon attended by President William A. Ray, J. F. Ray, vice president in charge of sales, and Fred E. Weldon, sales manager, who will be in charge of the new plant. Douglas S. Sterner, manager of refrigeration sales, will also make his headquarters in Skokie.

Built at a cost of approximately $750,000, the new structure has 60,000 sq ft of floor space located on a 5-acre lot. Additional land is available on the present site for future expansion. Housed in the building will be complete facilities for manufacturing General Controls' line of automatic controls for pressure, temperature, level, and flow; warehouse space adequate to serve the midwestern and eastern markets; and office and servicing facilities formerly located in the firm's Chicago offices.



General Controls, last month, completed construction and moved into this new plant in Skokie, Ill.

An early morning crowd stands in line waiting for souvenirs at the grand opening of the newly remodeled offices of Chattanooga Gas Co.

Expansion Completed By Chattanooga Gas Co.

As part of its three-year expansion program, the Chattanooga (Tenn.) Gas Co. recently completely remodeled and enlarged its headquarters in Chattanooga. Claimed to be "the South's finest utility offices," the building has been rebuilt from top to bottom at a cost of about $200,000. Offices have been enlarged and modernized, new systems of operations have been installed, and the building now has a modern streamlined front of granite, marble, stainless steel, and glass.

The expansion project, which was started in October 1951, has been carried out in connection with the coming of natural gas to Chattanooga to meet the tremendous increase in the use of gas that has already exceeded early estimates. The conversion to natural gas was carried out in September 1950 and since then the number of customers has increased about 41% and the amount of gas used has skyrocketed 525%. A big item in the expansion program was the laying of 65,000 ft of new mains ranging in size from 2 in. to 16 in.

Miscellany

W. O. Dannhausen Midwest Manager for Gas Magazine

William O. Dannhausen has been appointed Chicago district manager for Jenkins Publications. He took over management of the office on Sept. 30 from David Carmen, who plans retirement from active business.

W. O. Dannhausen

Mr. Dannhausen will handle all Jenkins publications, including *GAS, BUTANE - PROPANE News*, and *WESTERN METALS*. The new Jenkins representative is well known in advertising circles in the Chicago area. He has been regional manager for the publication *Tooling and Production* in the Chicago territory since 1949.

At the present time Mr. Dannhausen is a member of the Chicago Industrial Advertisers Assn. and is a former director of the t-f Club of Chicago.

Effective immediately, the Chicago office address of Jenkins Publications Inc. is 333 N. Michigan Ave. The telephone number is FRanklin 2-4615.

Pacific Gas & Electric Celebrates Centennial

The year 1952 is a pinnacle year as well as the centennial year for Pacific Gas & Electric Co., a California "native son" grown from small beginnings to one of the world's greatest utility systems.

At the company's centennial birthday party on Sept. 11, company employees celebrated the event of the founding of PG&E's earliest ancestor, Peter Donahue's tiny San Francisco Gas Co. Several hundred PG&E employees attended the banquet in the Palace hotel, including officers, directors, management personnel from the 46 counties served by the company, "old timers," and men from the ranks. All segments of the 18,579 employees were represented. The banquet launched a PG&E centennial celebration which will continue through December and feature a road show birthday party traveling over the utility's service area so that all employees may join in the fete.

The company climaxes a century of public service this year with new operating records.

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LIQUID GRAVITOMETER
NOW 5 MODELS
Indicating Transmitting Liquid Gravitometer
...for pipelines, gasoline and chemical plants, refineries, etc.
Ruggedly built for hard field use but with laboratory accuracy, the long accepted ARCCO-Anubis Liquid Gravitometer with all its splendid features is now available for recording, controlling, indicating, transmitting, or various combinations of these functions. Write us fully about your application and request Bulletin No. 111 Revised.
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SELL...

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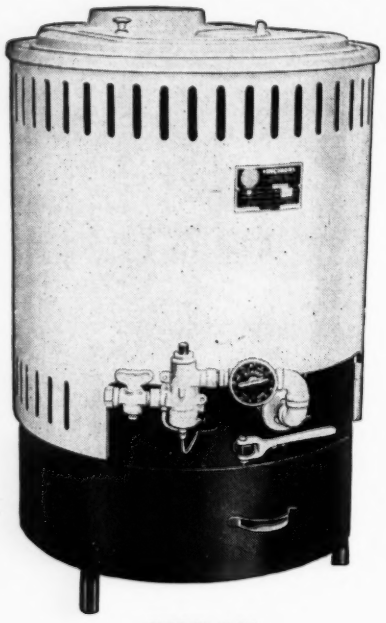
the gas-fired incinerator



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AUTOMATIC
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It's a "MUST" with automatic heat

Builders say, "it's just common sense to include Incinor — the modern way to dispose of wet or dry garbage and combustible trash."

Owners, by the thousands, say Incinor is indispensable—makes housekeeping easier.

Incinor's attractive finish fits into basement or utility room—and it's easy to install—easy to operate. Setting the clock turns on gas which is automatically turned off at end of burning time.

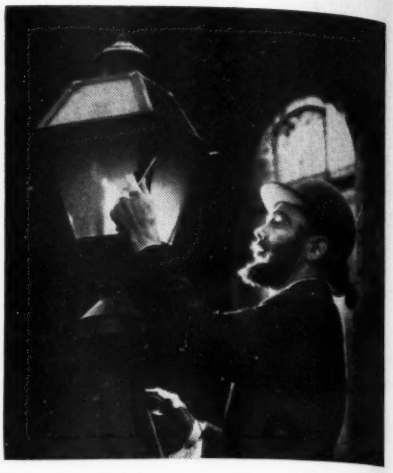
A.G.A. APPROVED
Approved by A.G.A. for use with natural, manufactured or mixed gases, or liquefied petroleum gases.

4-bu. commercial units also available.

Write TODAY for catalog and price schedule!

INCINERATION DIVISION
BOWSER, INC.
Dept. C Cairo, Illinois

John P. Coghlan, senior officer — vice president and assistant to the president since 1927, director since 1931, and employee for 46 years — cuts the cake, while President Black, Pierre, the Palace hotel chef, and Robert R. Gros, manager of advertising and publicity, look on.



The lamplighter, symbolic of the gas-lit era and indispensible in 1854, is the theme of PG&E's centennial celebration.

PG&E is nearing the billion dollar mark in investments in new gas and electric facilities since 1945; the company's total assets of almost $1.8 billion make it one of the largest combination utilities in the world. At the beginning of the year, an all-time record daily sendout of natural gas was established. The first sendout of more than a billion cubic feet a day in the company's history was made on Jan. 2 when 1039 MMcf were delivered to its customers.

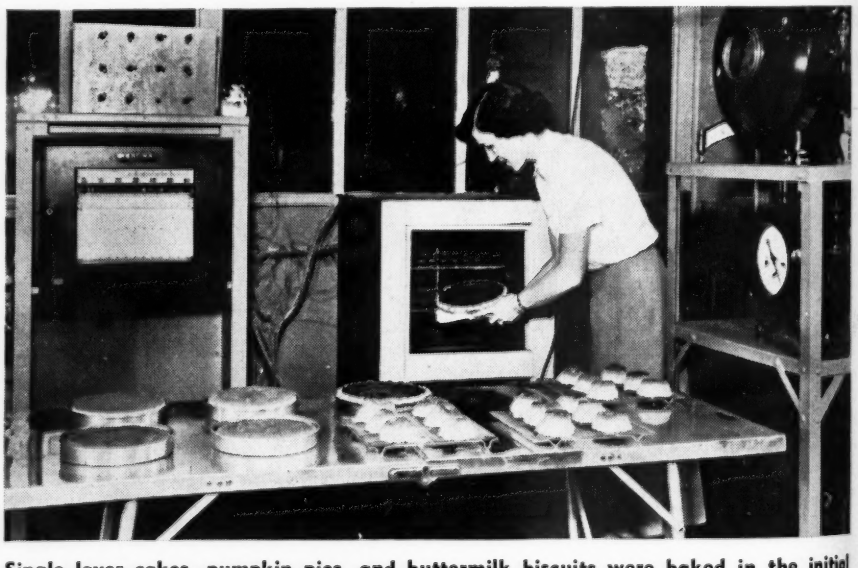
The humble beginnings of the utility industry in the days of the gold rush and the parallel histories of growth of the state of California and Pacific Gas & Electric were reviewed in the banquet program that included stage and screen personalities and addresses by company principals. Highlights of the party were the first showing of the road show and also of "A Century of Light," a color and sound motion picture of company history.

James B. Black, company president and a 40-year veteran in PG&E service, gave the welcoming address and delivered the principal address of the evening, paying respects to the company's forefathers, but talking of the future. "Looking back over the 100 years of achievement," he said, ". . . I am especially impressed by one fact: that without a single exception the 520 utilities comprising the present PG&E system were built by the initiative and enterprise of free men . . ." Referring to his company's billion dollar expansion, Mr. Black said the building pace will not slacken and that by the end of 1955 the company will have nearly trebled its prewar capacity.

PG&E, serving 89,000 sq miles encompassing 46 counties and a population of 5,220,000, has 1,114,452 gas customers, 14,400 miles of gas pipeline (2300 transmission, 12,100 distribution), and a gas capacity of 1200 MMcf of gas to customers in a 24-hour period.

AGA Lab Studying Design Fundamentals

An extensive study is underway at the American Gas Assn. Laboratories seeking to delineate design fundamentals which may contribute to improved oven cookery and promote cooler kitchens. The study, sponsored by the association's committee on domestic gas research as Project No. DGR-11-C,



Single layer cakes, pumpkin pies, and buttermilk biscuits were baked in the initial tests in this completely instrumented experimental oven designed by the Laboratories staff.

includes design factors affecting secondary air supply to oven burners, location and size of flue outlet, heat distribution and burner location, together with finding possible means to reduce heat losses and heat applied. A preliminary report, No. 1182, was published by the Laboratories in February and showed the quantities of radiated and convected heat absorbed by layers of cake in typical contemporary ovens.

The photograph was taken during initial tests with single layer cakes, pumpkin pies and buttermilk biscuits baked in a completely instrumented experimental oven. Designed by the laboratories' staff under supervision of Mrs. W. C. Anderson, laboratories home economist and research engineer, the oven is being used as one means of evaluating performance with changes in design. With only 140-150 Btu needed to bake a single layer cake, the research study is aimed at determining what actually happens during baking processes, how to utilize oven heat effectively, and thereby evaluate possibilities for reducing heat, moisture and cooking odors released from ovens. The satisfactory development of the design factors will contribute to advancing the technique of oven design and elevating still further the high standard of performance of contemporary ovens.

Newsnotes

Ohio Fuel Gas Co., Columbus, has announced plans to spend $5.4 million this year to boost capacity of its underground storage areas by 13%. The company, with more than 600 wells in its storage system at the end of 1951, intends to add 100 or more before the end of the year, drilling new wells, reconditioning old ones, and building high pressure lines to link the wells with other lines carrying gas to market. Present underground storage capacity is 100,000 MMcf; the expansion program will raise it to 113,000.

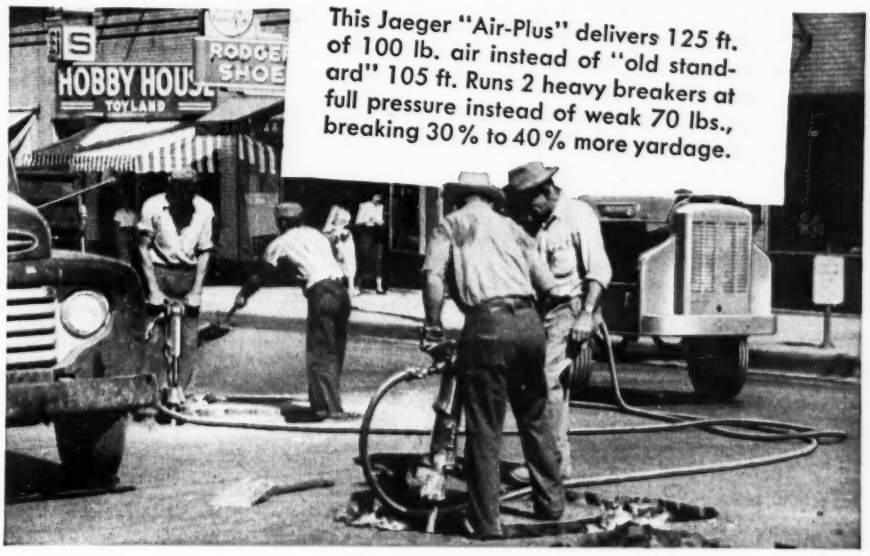
At the request of the AGA, the Department of Commerce has established a simplified schedule of standard packaging for malleable iron-screwed pipe fittings, black or galvanized finish, for 2-in. pipe size and under, having a 150-lb steam working pressure. Designated "Simplified Practice Recommendation R248-52," the schedule can be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for 5 cents per copy.

The Oklahoma Gas & Electric Co. has installed a second gas generator, rated at 7000 kilowatts, in its Belle Isle station at Oklahoma City. The economical cost of power generation of the first unit, installed in 1949, led to the installation of this second unit. Operating under a principle similar to jet airplanes, the generator's exhaust heat is used to help fire up additional boilers.

The last coke oven at the Rochester (N. Y.) Gas & Electric Co. was "pushed" in August, ending 104 years of gas manufacture by distillation of bituminous coal in Rochester. Natural gas from Texas and more efficient methods of producing manufactured gas ended the oven's usefulness.

Brooklyn Union Gas Co. completed conversion last month with the changeover of the last two districts in the company's area to natural gas.

You Can Do 4 Days' Work in 3 with "New Standard" Jaeger Compressors



This Jaeger "Air-Plus" delivers 125 ft. of 100 lb. air instead of "old standard" 105 ft. Runs 2 heavy breakers at full pressure instead of weak 70 lbs., breaking 30% to 40% more yardage.

75 ft. 30% to 40% increases in production are yours with any "new standard"
125 ft. Jaeger from Model 75 that holds full pressure in a heavy pavement breaker
185 ft. up to Model 600 that runs 2 heavy wagon drills at full pressure with air to
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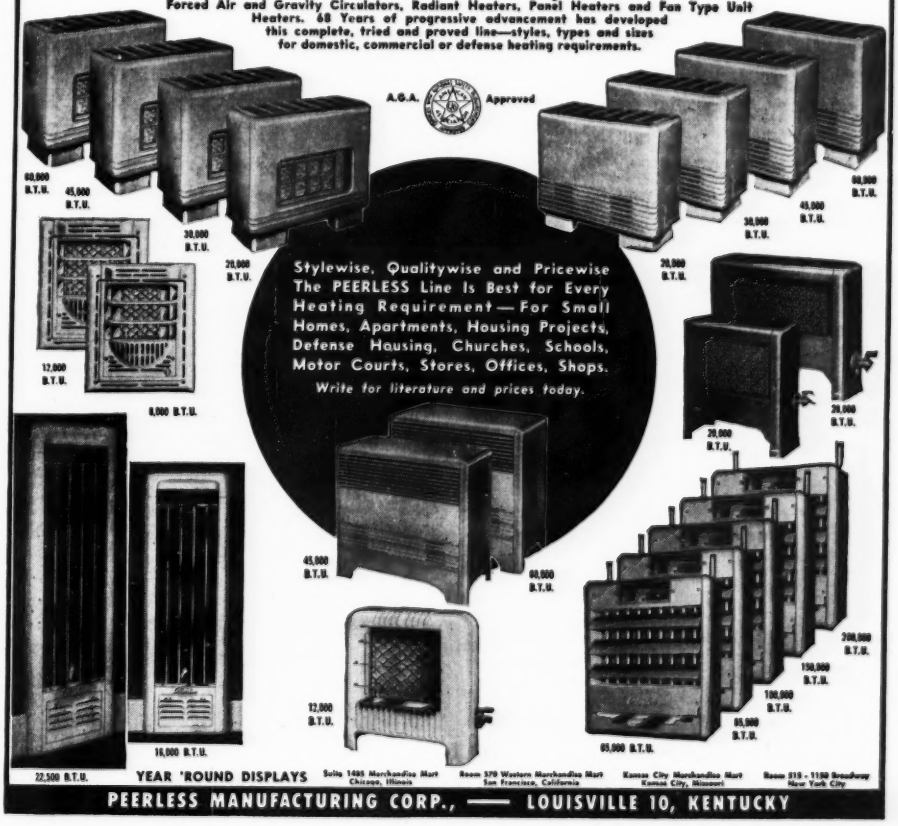
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Voluntary Reduction Made By SoCal in Rate Case

The most recent action taken by the Southern California Gas Co. in its long series of appearances before the state public utilities commission in Los Angeles was to reduce last month, voluntarily, its current request for a rate hike by $3,741,000.

The original petition was for $16,720,000; an interim boost of $4.8 million was granted the company last March. The reason for the voluntary reduction is that new and more favorable fuel contracts have been made representing savings in the utility's operations not contemplated when the original petition was filed.

Following SoCal's appearance before the PUC, Southern Counties Gas Co. began presentation of evidence in support of its plea for a $4,852,000 increase. A previous request for a general rate increase was denied by the commission in January 1952. The company appealed from this decision to the state supreme court, but the court declined to issue a writ of review.

Other rate actions during the past month involved the Lone Star Gas Co., Dallas, raising rates from 3½ to 15% to about 3000 Texas industrial customers. This is not a part of Lone Star's move for increased residential and commercial rates which have already been applied for or are about to be applied for affecting the company's 387-community system.

In Tampa, Fla., the Tampa Gas Co. has applied to the state railroad and public utilities commission for increases in rates to three classes of consumers: residential, commercial, and industrial.

UGI Acquires Facilities Of Five Subsidiaries

Early in September the FPC authorized the United Gas Improvement Co., Philadelphia, to acquire the natural gas facilities of five Pennsylvania subsidiaries: Allentown Bethlehem Gas Co., Consumers Gas Co., Reading, Harrisburg Gas Co., Lancaster County Gas Co., and Lebanon Valley Gas Co., Lebanon. The five companies serve areas located in nine counties in southeastern Pennsylvania, extending eastward from the Susquehanna river to the Delaware.

United Gas Improvement said that the merger will result in greater efficiency and economy in the operation of its facilities, will effect a tax saving, and will remove UGI from the status of a holding company. Upon acquisition of the facilities, UGI plans to continue operation and to render all services "in exactly the same manner as they are presently being operated and rendered," except that there will no longer be any sale for resale to Labanon Valley Gas by either Harrisburg or Consumers.

Gas Sales to Consumers Reach All-Time High

Large increases are evidenced in total revenues of the gas utility and pipeline industry in the second quarter as sales of gas to ultimate customers reached $555 million, an increase of 7.6% over the $516 million in the comparable period of 1951, AGA reports. Industrial revenues were 9.0% higher while revenues from residential and commercial gas sales were 7.4% and 7.7% higher, respectively.

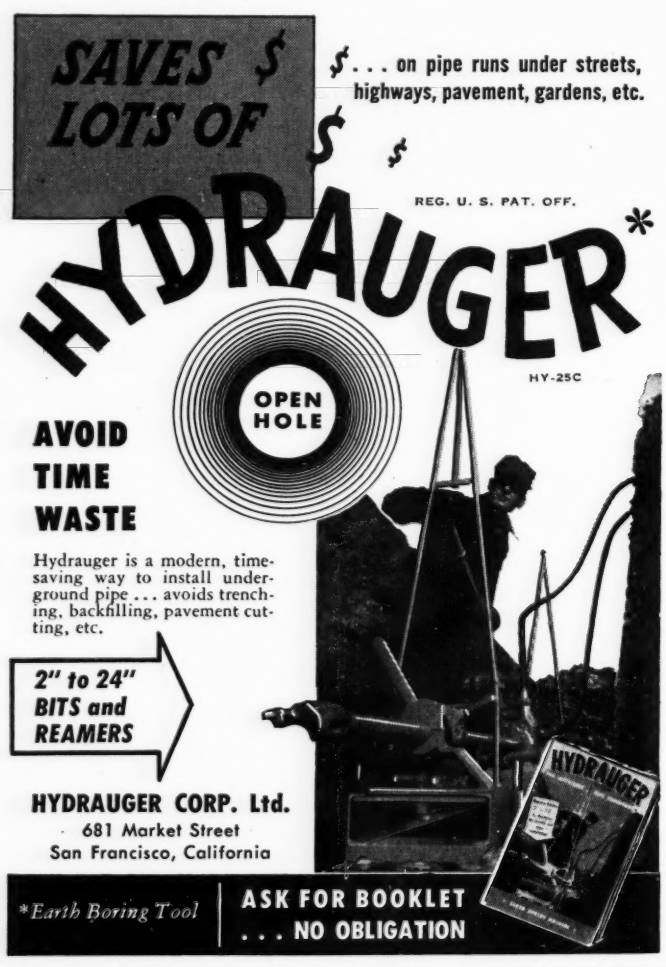
Revenues from the sale of natural gas to ultimate consumers by utilities gained 13.2% during the second quarter compared to 1951. The largest advance took place in the residential category with revenues gaining 15.0%, to reach a total of $236.1 million.

During the 12 months ending July 31, 1952, gas utility sales aggregated 49,997 million therms, representing an increase of 8.8% over sales of 45,972 million therms in the previous corresponding cumulative period. Natural gas utility sales rose 9.6% to 46,612 million therms.

Operating Revenues Up

Operating revenues of natural gas companies reporting to the FPC totaled $119,189,498 in June 1952, a 13.3% gain over a like period in 1951. For the 12 months ended June 30, revenues aggregated $1,737,549,949 or 17.5% higher than the $1,478,577,785 received in the 12 months ended June 30, 1951.

Gas utility operating income for June 1952, amounting to $14,654,829, was up 3% over the $14,231,308 last year. For the 12-month period, $261,709,010 represented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Pipe sizes 2" thru 24"

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Denver 2, Colo., 1921 Blake Street
Los Angeles 48, Calif., 6399 Wilshire Blvd.
San Francisco 4, Calif., 235 Montgomery Street
Portland 4, Oregon, 501 Portland Trust Bldg.
Salt Lake City, Waterworks Equipment Co.

an increase of 10.2% over $237,509,092 reported for the comparable period ended in June 1951.

Gas sales to ultimate consumers during the month were 169,025 MMcf, a 3.2% boost. Sales to residential consumers were up 7.3%; to commercial, up 7.7%; to industrial, 1.2%.

Mississippi Drops Efforts To Gain Control of Laclede

The lengthy battle between Laclede Gas Co. and Mississippi River Fuel Corp., both of St. Louis, over control of Laclede ended early in September when Mississippi River's president, William G. Marbury, announced abandonment of its efforts to control the utility.

According to the announcement, the chief reason for the abandonment was Laclede's plan for underground storage of gas. When Mississippi filed its petition for control of Laclede with the Missouri PSC in June, Mr. Marbury said the motive for that move was unsatisfactory business relationships between the two companies.

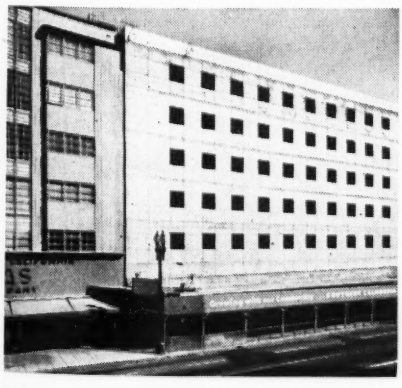
In announcing dismissal of the petition, Mississippi also disclosed that its $2 million experiment in development of an underground storage area near Waterloo, Ill. had been unsuccessful. The company still hopes to use some part of the area for storage but on a drastically reduced scale. The 248,400 shares of Laclede common stock now held by Mississippi—about 8% of the total—will be considered "purely as an investment" and will be disposed of when an advantageous price can be obtained.

Robert W. Otto, Laclede president, when informed of Mississippi's action, expressed hope that Laclede's site for underground storage, the Florissant area in St. Louis county, would prove practical. If it is shown to be impractical, a new site will be sought inasmuch as the company wants to provide sufficient storage to heat an additional 50,000 homes in the area.

Financial Notes

An amended plan for liquidation has been filed with the Securities & Exchange Commission by Pennsylvania Gas & Electric Corp. affecting North Penn Gas Co., Port Allegany, Pa., and Crystal City Gas Co., Corning, N. Y. Informal approval has been received from the utility division of the SEC, but before the plan can be consummated approval of the SEC and other regulatory bodies is necessary, as well as an order of the U. S. District Court.

The merger of Consolidated Electric & Gas Co., New York, into Central Public Utility Corp. became effective last month under an amended plan approved by the Securities & Exchange Commission and the courts.



Construction is proceeding rapidly on this new 6-story loft type structure being built for the Southern California Gas Co. adjacent to its headquarters buildings in Los Angeles. The new building, which will be used for additional office space, is scheduled for completion in January 1953.

Manufacturers

Southern Union Installs Plastic Main in Galveston

The Southern Union Gas Co. on June 22 installed 200 ft of Perrault Fibercast pipe as a gas main in the city proper of Galveston, Texas. This is the first time that the product has been used in such an installation.

According to P. E. Nicholls, district manager, and Wallace Norton, distribution superintendent, the earth in this particular area induced excessive corrosion into their former steel mains, causing leakage in a comparatively short time.

Fibercast pipe is a glass-fiber reinforced plastic pipe which has been used extensively in the oil industry for transporting corrosive liquids such as salt water and dilute acid solutions.

Four ¾-in. customer service connections

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Plastics Pipe Tubing

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½" to 4" IPS	Up to 4½" O.D.

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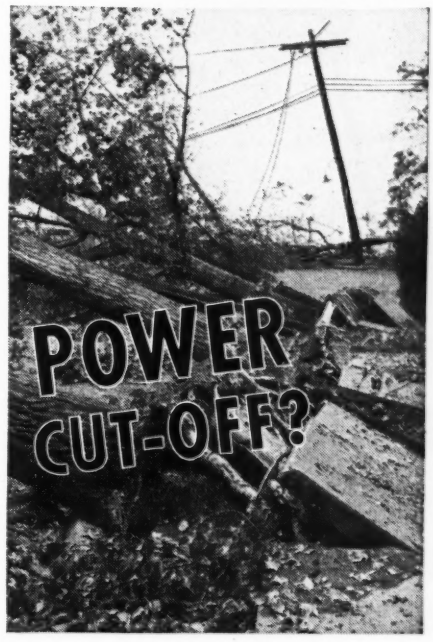

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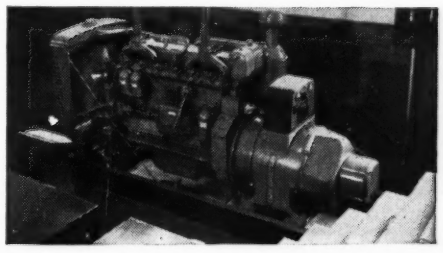

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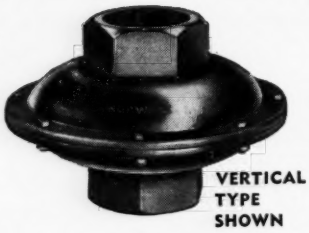

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a Knott Hotel

Joseph F. Duddy, Manager

In this service connection, a 3/4-in. galvanized pipe is screwed and cemented into Fibercast main through reinforcing boot on main.

were screwed into the line through reinforcing shoes chemically welded on the pipe for additional thickness. (See photo.) The main is 3½-in. OD with .20-in. wall thickness and will withstand 200 psi working pressure. The highest expected pressure on this main will be 30 psi.

Single Port Pilot Designed

A new type single port pilot for top burners resulting in a one-third reduction in gas consumption and a 40° drop in top-of-range temperature has become standard equipment for all Universal gas ranges, according to Wendell C. Davis, president of Cribben & Sexton Co., Chicago.

Problems originally found in the single-port tip have been overcome through the development of a steel, cadmium plated cone which surrounds the pilot light and causes the flame to be more stable. In conjunction with the single port pilot, Cribben & Sexton has also developed an aluminum channel pilot flue which disperses the heat evenly throughout the area under the main burner. It is claimed that through the use of this combination, a temperature drop to 110° is effected from the usual 150° on top of the range.

Celebrates 25th Anniversary

In celebration of 25 years in business on Chicago's far south side, employees of Harper-Wyman Co. surprised Philip S. Harper, founder of the company, with a luncheon on Aug. 22. Mr. Harper was presented with a wrist watch and scroll commemorating the occasion. The concern is one of the largest manufacturers of gas burners, valves and automatic lighters for domestic gas ranges and is the leading engineering concern in gas cooking burner design and construction.

Manufacturers Notes

Four new distributors have been appointed by Hamilton Manufacturing Co., Two Rivers, Wis. Allied Appliances Inc. will handle Hamilton dryers in Denver, Colo. and the surrounding territory; Tri State Electric Co., Sioux Falls, will cover the state of South Dakota; and the Maloney Distributing Co. has the state of Florida. Gordon E. Wilkins Ironers Inc., Los Angeles, will cover Arizona and the southern California territory.

Under an agreement with the Canadian Standards Assn., manufacturers of gas appliances carrying electrical components may

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CALENDAR

October 1952

1-3....Wisconsin Utilities Assn. Technical and Sales Section Convention—Schroeder hotel, Milwaukee.

1-3....National Assn. of Corrosion Engineers South Central Region meeting—New Orleans.

6....Independent Natural Gas Assn. of America Annual Meeting—Fontenelle hotel, Omaha.

7-9....Pacific Coast Regional Restaurant Convention and Exposition—Biltmore hotel, Los Angeles.

10-11....California Natural Gasoline Assn. Fall Meeting—Ambassador hotel, Los Angeles.

20-24....40th National Safety Congress & Exposition of the National Safety Council—Chicago.

20-24....National Metals Exposition — Commercial Museum, Philadelphia.

21-24....American Dietetic Assn. Exposition—Minneapolis.

23....Institute of Gas Technology Annual Meeting—Technology Center, Chicago.

27-30....American Gas Assn. Annual Convention—Atlantic City, N. J.

27-31....GAMA Exposition — Atlantic City, N. J.

November

10-13....American Petroleum Institute Annual Meeting—Chicago.

10-14....National Hotel Exposition—Grand Central Palace, New York.

19....American Standards Assn.—Waldorf-Astoria, New York.

20-21....Mid-Southeastern Gas Assn.—The Sir Walter hotel, Raleigh, N. C.

30-Dec. 5....American Society of Mechanical Engineers—Hotel Statler, New York.

January 1953

19-21....Pipe Line Contractors Assn. Annual Convention & Exhibition—Shamrock hotel, Houston.

February

2-4....AGA Home Service Workshop—Baker hotel, Dallas.

March

16-20....National Association of Corrosion Engineers—Hotel Sherman, Chicago.

26-27....Oklahoma Utilities Assn. Annual Convention — Tulsa hotel, Tulsa.

26-27....New England Gas Assn.—Hotel Statler, Boston.

30-Apr. 1....Midwest Gas Assn. Annual Convention — Broadmoor hotel, Colorado Springs.

April

12-16....AGA Distribution, Motor Vehicles and Corrosion Conference—Hotel Sherman, Chicago.

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WANTED DIRECT FACTORY REPRESENTATIVE. A company now manufacturing a field proven control device for gas and air is about to start a program for national distribution. During past year several thousands of this device in sizes for ¾" to 12" pipe line have been installed in the Chicago area. Product has patented exclusive features not duplicated in competitive devices. Highly recommended. To qualify you must now be calling upon the gas divisions of public utilities and large industrial gas users. In reply state companies you now represent and territories regularly covered. Address Box 210, GAS, 198 So. Alvarado, Los Angeles, Calif.

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now have their equipment examined by the AGA Laboratories for compliance with the Canadian electrical code.

Black, Sivalls & Bryson Inc. recently celebrating its 60th year of continuous operation, has almost completed its $2 million expansion of plant facilities. The program includes expansion of the Oklahoma City plant, adding 57,000 sq ft of manfacturing area; the addition of about 78,000 sq ft of manufacturing and storage space at the Kansas City plant; and a new welding shop, wood shop, and combination office-warehouse at Odessa.

Donie Engineering Sales Inc. has become manufacturers' agent for distribution of A. O. Smith safety grating in Indiana. The firm headquarters in Indianapolis.

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Sales and Promotion

Range Promotion Launched

Frank H. Trembly Jr., vice president in charge of sales of Philadelphia Gas Works Co., has announced that a bigger and better "matchless" gas range campaign will be launched in the Philadelphia area.

The utility, and six participating range manufacturers, plans a three months' effort to promote the features of fully automatic gas ranges with oven clock control by means of an extensive newspaper advertising schedule, car cards, billboards, and PGW-manufacturer-dealer cooperative local advertising in various media.

Dealer packages will consist of a decorated window display, dealer listings in three of the utility's ads, and sales floor displays. Demonstrations and cooking schools, co-sponsored by newspapers, will be held throughout the city with each participating manufacturer's product featured and presented as a grand prize.

Air Conditioning Grows

The market for aid conditioning equipment in homes is a growing one, and manufacturers are raising their production sights for next year by 30 to 100%. General Electric predicts industry sales next year will reach 400,000 units, up 14%. GE actually plans to boost production by 35% and believes that by 1961 a million room air conditioners will be sold annually. Universal Appliances of Lima, Ohio is considering a 75% production increase; Fedders a 50% increase; Crosley, 75%; Carrier is looking for a 50% sales increase; Servel is stepping up output of its year-round conditioner for cooling and heating and may have a room unit in the highly competitive market.

Sales Notes

GAMA estimates that 436,800 gas heating units were shipped in the first 8 months of 1952 compared with 387,700 during the January-August period in 1951. Domestic ranges were down 19.9% — 1,162,800 ranges going out in 1952 compared to 1,452,100 in the 8-month period of 1951. Shipments of automatic gas water heaters during comparable periods totaled 1,037,200 for 1952 and 1,263,000 for 1951, a decrease of 17.9%.

However, monthly figures show that in August range shipments were up 6.5%; and water heaters increased 35.0%; and central heating equipment were up 83.2%.

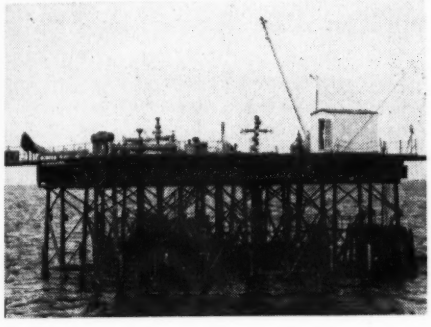
About 400 utilities throughout the country will participate in an AGA program to promote the sale of automatic gas clothes dryers, many of them in cooperation with appliance dealers. Industry calculations anticipate the sale of more than 6 million dryers during the next five years. The theme is "Fresher Than All Outdoors."

GAS
PIPELINE NEWS AND FEATURES

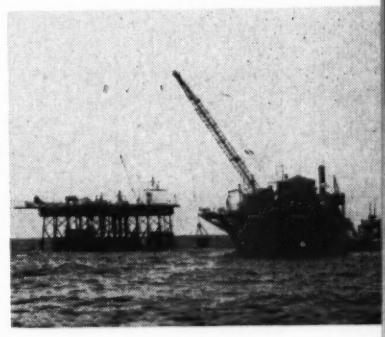
United Completes More Underwater Lines

Another Louisiana tidelands gas field was connected to United Gas Pipe Line Co.'s coastal transmission network recently to become the fourth offshore platform feeding into the system from the Eugene Island area. These pictures show some of the work required to accomplish the laying of the 12-mile, 10-in. line beneath the Gulf waters to the drilling platform at Magnolia Petroleum Co.'s Block 95 from the platform at Block 51 where the existing gathering system ended.

As *GAS* went to press, construction of another underwater section of line was almost finished. The new 44-mile, $3.5 million line, 10 miles of which are underwater, will be completed this month, weather permitting. It will extend from United's Mustang Island fields in Corpus Christi Bay to Refugio and will be capable of moving 130 MMcf per day under the bay.

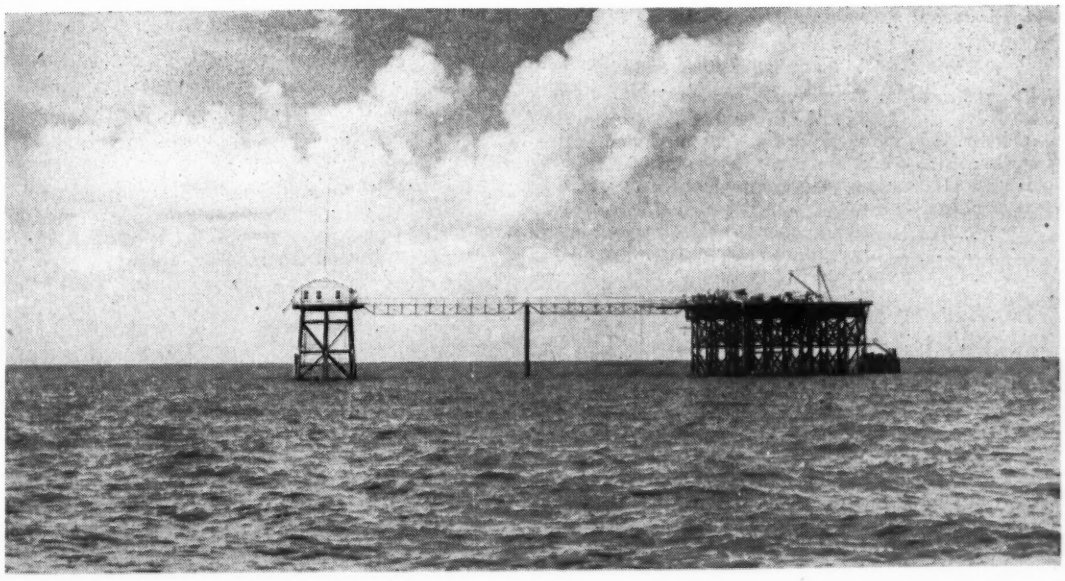


Closeup of the drilling platform. Twelve miles of line now link the two platforms.



A construction barge dredging near the drilling platform which was the destination of the line.

The line begins at this platform some 30 miles off the coast. Note the living quarters for operating personnel on the separate platform at left.



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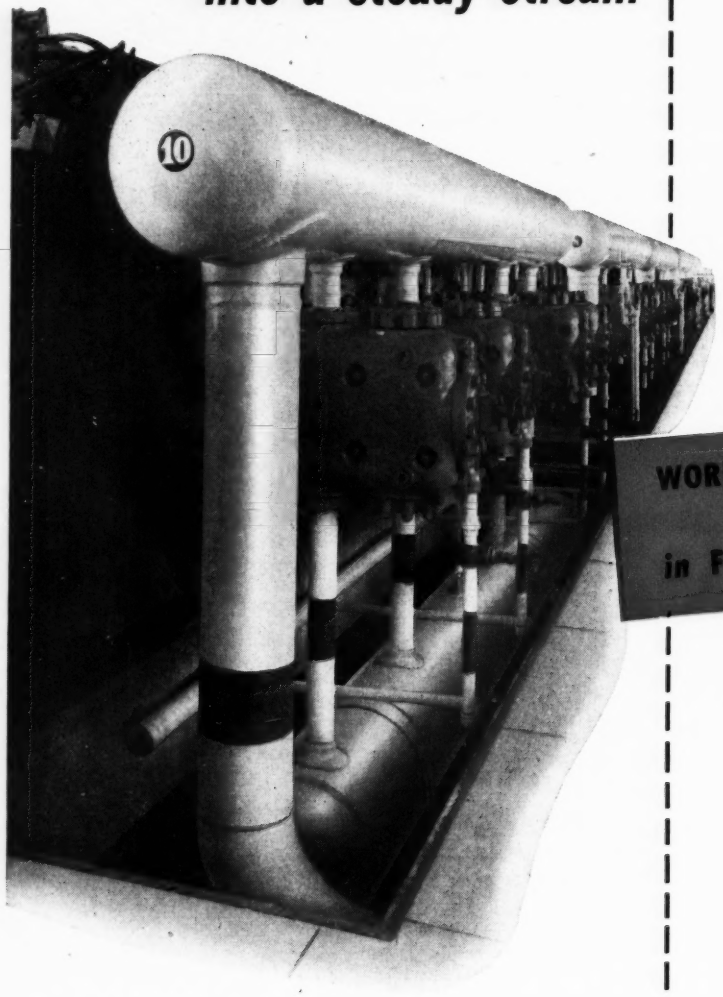

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Fluor Pulsation Dampeners work at the cause of the trouble. Their unique design principle smooths out pulsations to the extent of at least 85%. This means that damage to piping, coolers, heat exchangers, processing equipment and even buildings will be eliminated. It means reduced maintenance, more accurate gas metering and smoother, safer, more efficient plant operation.

Fluor Pulsation Dampeners are used on any type gas stream—air, steam, hydrocarbons—at operating pressures ranging from vacuum to 5,000 psi. Dimensions can be tailored to fit space limitations. Units may be installed on the suction and/or discharge lines and are sufficiently flexible to meet minimum pressure drop requirements.

WORKMANSHIP and PERFORMANCE are guaranteed in FLUOR PULSATION DAMPENERS

Performance and workmanship are guaranteed in every instance where a Fundamental Pulsation Dampener or Pulsation Dampening System is installed. Here are excerpts from the guarantee:

"The Fluor Corporation, Ltd., guarantees that the pulsation dampeners or pulsation dampening systems . . . conform to all specific code requirements, and the workmanship is in accordance with standard shop practice by qualified welders."

". . . that the equipment will satisfactorily correct conditions of piping vibrations which are due to excessive pulse pressure in the piping system, or correct inaccurate gas metering caused by pulsative flow . . ."

". . . that the dampeners or pulsation dampening systems will decrease the magnitude of the pulse pressure in the compressor plant header piping to a value not to exceed 1.25 percent of the compressor operating pressure. The above percentage reduction applies to both suction and discharge pulsation dampeners or dampening systems . . ."

". . . that the pulse pressure in the plant header piping will not exceed the pulse pressure which is measured in the lateral between the volume bottle and the suction or discharge header, respectively."

". . . that the total pressure loss through the pulsation dampeners or pulsation dampening systems, measured by means of a differential pressure indicator and expressed in pounds per square inch, will not exceed the value set forth on the attached Dimensional Outline Sheet or layout drawing . . ."

Contact your nearest Fluor representative for the answer to your specific pulsative flow problems. Following preliminary study, he will be pleased to recommend the Fluor Pulsation Dampener that best fits your particular requirements. Or, write The Fluor Corporation, Ltd., Los Angeles 22, California.

Two Fluor "Package Type" Models

Fluor Pulsation Dampeners are available in two models: the Fundamental and the Higher Frequency. The Fundamental is recommended for installation in all compressor piping systems where excessive vibration is caused by peak pulse pressures at the fundamental frequency. The Higher Frequency Pulsation Dampener is recommended where frequencies are encountered above the fundamental (second harmonics or higher frequencies).

The Fluor Pulsation Dampening Piping System

Designed primarily for new construction, Fluor Pulsation Dampening Piping Systems are furnished in prefabricated form, ready for installation. Systems are designed for any type gaseous stream at operating pressures ranging from vacuum to 5,000 psi. Advantages include: improved flow measurement, fewer maintenance requirements, protection of related equipment, and smooth operation of plants and stations at rated capacity. Write for Bulletin PDS-8501.

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BE SURE WITH FLUOR

A working method for

Predicting Supercompressibility Factors

By RICHARD H. ZIMMERMAN and SAMUEL R. BEITLER

Both S. R. Beitler (left) and R. H. Zimmerman are on the mechanical engineering staff at Ohio State University, Mr. Beitler since 1921, Mr. Zimmerman since 1946.

Mr. Beitler has headed the ASME research committee on fluid meters, authored a textbook on hydraulic machinery and many articles on flow measurement.

THE quantity of natural gas which is produced, transported, or sold is usually measured in terms of cubic feet at some standard pressure and temperature known as the base pressure and temperature. The measurement of the gas is, in many instances, made at conditions which differ from the base conditions. The value of the volume at measured conditions is normally converted to the volume at base conditions by use of the perfect gas law.

Exclusive

It has long been realized that natural gas is not a perfect gas so that a correction factor must be applied to the gas law to obtain correct volumetric calculations. The correction factor has been called the "compressibility factor." Present practice as recommended in report number 2 of the Orifice Meter committee of the American Gas Assn. is to apply a compressibility factor determined from test for the gas being measured. This method is unsatisfactory unless the gas being measured has approximately the same composition at all times since otherwise it is necessary to take samples of the gas at various intervals and test these samples with an apparatus available for measuring the factor. The test is time consuming and expensive if frequently required and is not commercially practical, especially for relatively few measurements. Realizing these problems, measurement engineers have been working in an attempt to correlate the compressibility factor with commonly measured and generally known properties of the gas, i.e. specific gravity, heating value and carbon dioxide content, so that the factor can be continuously determined without too great cost.

Several methods are presently in use for predicting this factor. The methods are considered satisfactory for natural gas mixtures when the pressure is less than 500 psig, and are fairly accurate for pressure a few hundred pounds per sq in. higher. However, for high pressure gas often met in present practice, tests have indicated that available methods do not yield results which check actual tests within the range of allowable measurement accuracy.

A research program has been started to determine the possibility of developing a method giving good agreement between predicted and measured values over the entire range of conditions encountered in normal gas measurements. The study is to cover the pressure range of zero to 4000 psi.

This is a report of some of the progress made to date on this program. Deviation factors are presented as the reciprocal of the square root of the compressibility factor and are referred to as the "supercompressibility factor, F_{pv}"

$$F_{pv} = 1/V\overline{Z}$$

where

$$Z = pv/RT$$

Numerical values of F_{pv} are evaluated on the basis of being equal to unity at a base pressure of 14.4 psia.

Test Program

The complete test program will determine the supercompressibility factors for pressures varying from zero to approximately 4000 psig for natural gas mixtures having various specific gravities, fractional analyses and temperatures. Supercompressibility factors are being determined by use of the Burnett type apparatus, following standard procedure[1, 2]. In addition, specific gravity, heating value and the fractional analysis are being determined for each gas sample.

Nomenclature

F_{pv}	supercompressibility factor of gas mixture, based on reference pressure of 14.4 psia.
G	specific gravity of gas mixture, referred to molecular weight of 28.97.
G_h	specific gravity of hydrocarbon fractions, referred to molecular weight of 28.97.
H	gross heating value of gas mixture, dry basis, Btu per cubic foot at 60° F and 14.73 psia.
H_h	gross heating value of hydrocarbon fractions, dry basis, Btu per cubic foot at 60° F and 14.73 psia.
P	gauge pressure of gas mixture, pounds per square inch.
P_R	reduced gauge pressure of gas mixture, P/π.
T	absolute temperature of gas mixture, degrees Rankine.
T_R	reduced absolute temperature of gas mixture, T/Θ.
X_h, X_c, X_n	mol per cent hydrocarbon fractions, mol per cent carbon dioxide and mol per cent nitrogen, respectively divided by 100.
Z	compressibility factor of gas mixture, based on reference pressure of 14.4 psia.
Θ	pseudo-critical absolute temperature of gas mixture, degrees Rankine.
$\Theta_h, \Theta_c, \Theta_n$	pseudo-critical absolute temperatures of hydrocarbon fractions, carbon dioxide and nitrogen, respectively, degrees Rankine.
π	pseudo-critical absolute pressure of gas mixture, pounds per square inch.
π_h, π_c, π_n	pseudo-critical absolute pressure of hydrocarbon fractions, carbon dioxide and nitrogen respectively, pounds per square inch.

Table 1. Breakdown of Average Fractional Analysis of Gas Samples

Hydrocarbon Fractions		Carbon Dioxide Plus Nitrogen	
99.2%		0.8%	
92.9% methane	6.3% ethane plus higher fractions	0.4% carbon dioxide	0.4% nitrogen

Over 400 tests have been reported to date. Most of the gas samples used in test were taken from fields in Texas. The emphasis in the first phase of the test program has been at low pressures. However, high pressure tests are now being conducted. The maximum test pressure is below 1100 psig for roughly 95% of all tests conducted to date. Test temperatures cover a fairly wide range but over 90% of the tests were made in the range 50° F to 120° F. Many test runs were duplicated to insure against possible error in experimental technique.

Character of Gas Samples

The principal constituents to be considered in a study of supercompressibility factors for natural gas mixtures are the hydrocarbon fractions, carbon dioxide and nitrogen. Traces of other gases such as hydrogen, oxygen, hydrogen sulfide, etc. are sometimes found to occur but generally are absent and for this reason are not given consideration in the development of a working method for predicting supercompressibility factors.

The predominant gas existing in all mixtures is, of course, methane, and, although present in varying degrees, it almost entirely suffices to denote the singular character of the typical natural gas mixture. The average methane content of a large number of gas samples was found to be 92.9% by volume. Low methane content almost invariably results from high nitrogen and/or carbon dioxide content. A breakdown of the average fractional analysis of many samples is shown in *Table 1*. Although the average carbon dioxide plus nitrogen content is less than 1.0%, this is not intended to imply that it is permissible to neglect these constituents when developing a method to define supercompressibility factors of natural gas mixtures, for with some mixtures the carbon and/or nitrogen content may be appreciable.

Table 2 gives a breakdown of the carbon dioxide contents for all samples. Nearly 60% of the samples have less than 0.25% by volume and 87% less than 1.0%. The breakdown of the nitrogen contents is shown in *Table 3*. Well over 80% of the samples have no detectable amount of nitrogen, and nearly 95% have less than 10%. The content in several samples is, however, quite high.

Table 2. Breakdown of Carbon Dioxide Contents

Carbon Dioxide Content, %	Per Cent Samples
nil to 0.25	58
0.25 to 1.0	29
1.0 to 2.0	7
2.0 to 3.0	4
3.0 to 4.0	2

Table 3. Breakdown of Nitrogen Contents

Nitrogen Content, %	Per Cent Samples
nil	84
nil to 1.0	10
1.0 to 3.0	4
12.57	1
18.27	1

Table 4. Breakdown of Methane Contents in Hydrocarbon Fractions of Samples

Per cent methane on the basis of hydrocarbon fractions only. Average per cent methane, 93.80.

Methane Content, %	Per Cent Samples
99 to 100	7
95 to 99	34
90 to 95	46
85 to 90	13
below 85	0

Considering the hydrocarbon fractions only, the average analysis on a per cent by volume basis is 93.80 methane, 3.70 ethane, 1.45 propane and 1.05 butanes and higher. The breakdowns of the various contents of these gases are given in *Tables 4* and *5*. The hydrocarbon fraction consists of over 90% methane in 87% of the samples, has less than 5% ethane in 78% of the samples and less than 3% propane in 89% of the samples. The butanes and higher fractions represent less than 2% of the hydrocarbon fractions in 88% of the samples. Although not shown in the tables, the butanes have an average content of about 0.64%, the pentanes about 0.21, hexanes 0.15 and 0.07 heptanes plus.

The specific gravities as determined by test varied from 0.559 to 0.711. The average specific gravity for all samples is 0.616. Gross heating values on a dry basis averaged to 1082 Btu per cu ft at 60° F and 14.73 psia.

Correlation Method

Various methods for predicting supercompressibility factors of natural gas mixtures are available [3, 4, 5, 6]. All methods specifically designed for predicting values at high pressure utilize the "law of corresponding states," the concept of pseudo-critical temperature and pressure and the generally accepted rule that critical temperature and pressure of a paraffin hydrocarbon mixture may be defined by its specific gravity. With consideration given to overlapping of the various methods, the method proposed by Dunkle[6] appeared most promising, not only because of apparent agreement between predicted results and test data, but primarily owing to its make-up on the basis of methane as the only hydrocarbon. The framework of the method proposed by Dunkle consists of using supercompressibility factors of methane expressed in terms of reduced temperature T^R and reduced gauge pressure P^R as the basis for evaluation of supercompressibility factors of mixtures of hydrocarbon fractions, carbon dioxide and nitrogen. This assumes the "law of corresponding states" valid for any mixture, meaning that for the same reduced temperature and pressure the supercompressibility factor of a mixture equals that for methane alone. This assumption may be justified only because the principal constituent of a natural gas mixture is methane, and, hence, any errors introduced because of deviations from this law should have negligible effect on the accuracy of the predicted value for the mixture.

The reduced temperature of a gas mixture is defined as the ratio of the absolute temperature T to its pseudo-critical temperature Θ, where the pseudo-critical temperature of a mixture is defined by the standard rule

$$\Theta = X_h \Theta_h + X_c \Theta_c + X_n \Theta_n \qquad (1)$$

The reduced gauge pressure of a mixture is defined as the ratio of the gauge pressure of the mixture P to its pseudo-critical pressure π, where

$$\pi = X_h \pi_h + X_c \pi_c + X_n \pi_n \qquad (2)$$

Fig. 1 shows a plot of the gross heating value on a dry basis as a function of the specific gravity, both coordinates expressed on a pure hydrocarbon basis. The test points shown in *Fig. 1* cover all gas samples employed to date in the deviation tests. A best straight line passing through the heating value for pure methane and the other points is given by the solid line and is represented by

$$H_h = 186.0 + 1489\, G_h \qquad (3)$$

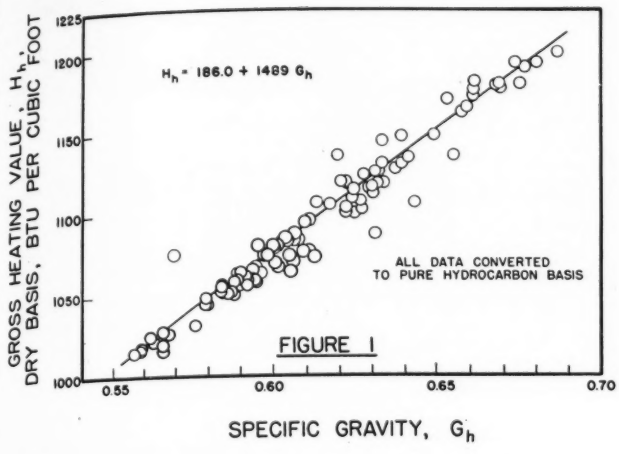
H_h = 186.0 + 1489 G_h
ALL DATA CONVERTED TO PURE HYDROCARBON BASIS
GROSS HEATING VALUE, H_h, DRY BASIS, BTU PER CUBIC FOOT
SPECIFIC GRAVITY, G_h

FIGURE 1

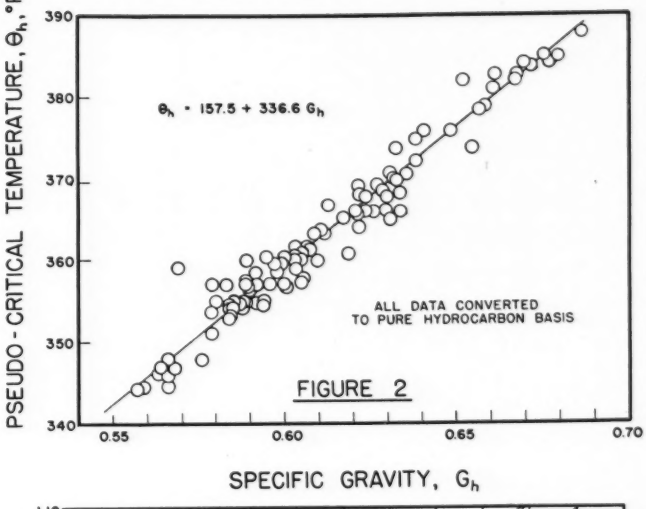
θ_h = 157.5 + 336.6 G_h
ALL DATA CONVERTED TO PURE HYDROCARBON BASIS
PSEUDO-CRITICAL TEMPERATURE, θ_h, °R
SPECIFIC GRAVITY, G_h

FIGURE 2

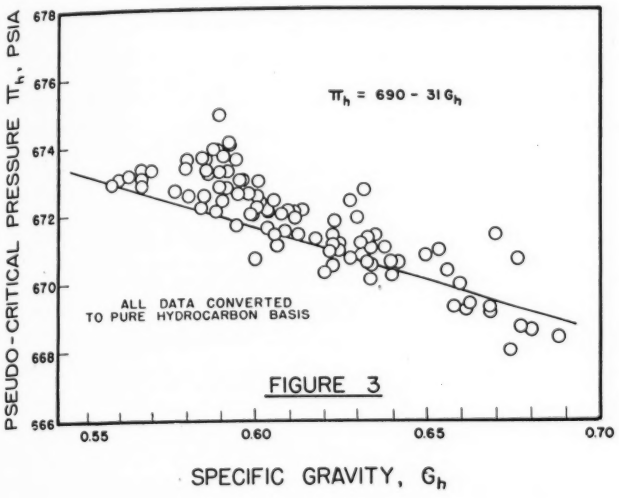

FIGURE 3

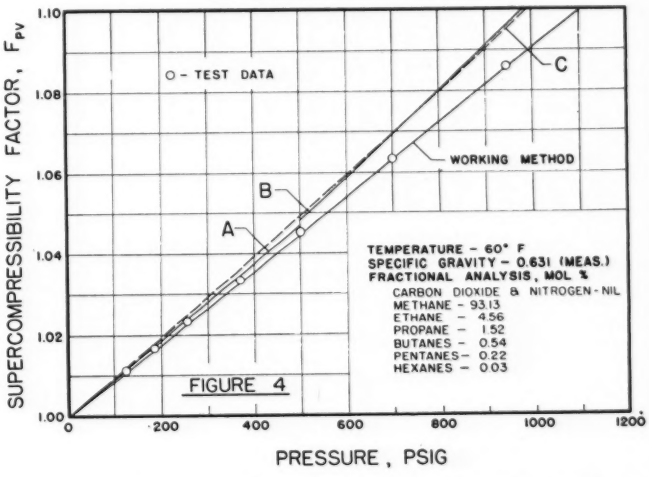

FIGURE 4

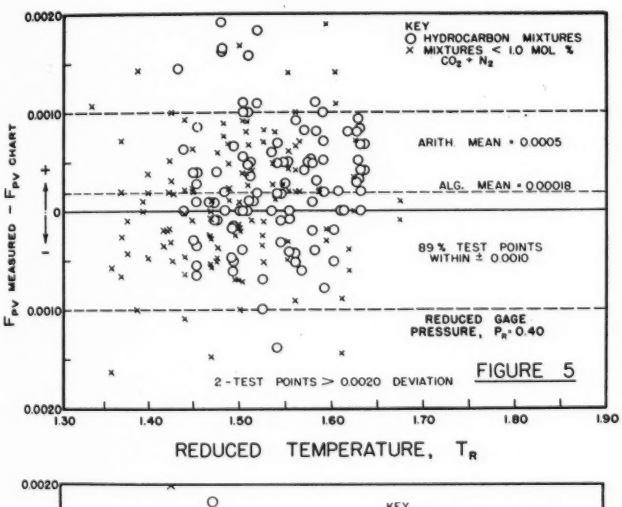

FIGURE 5

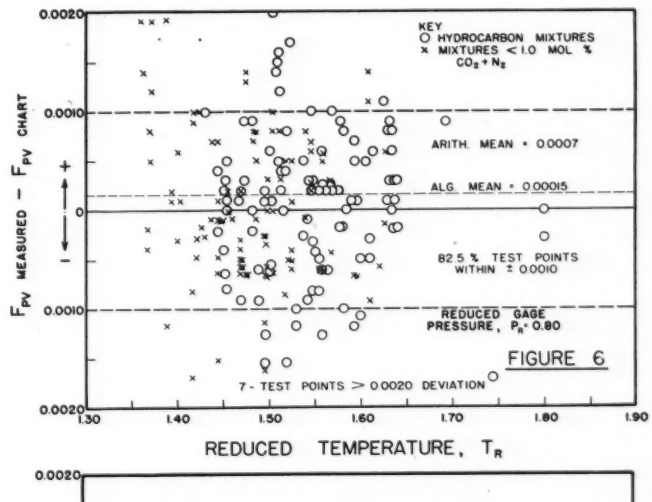

FIGURE 6

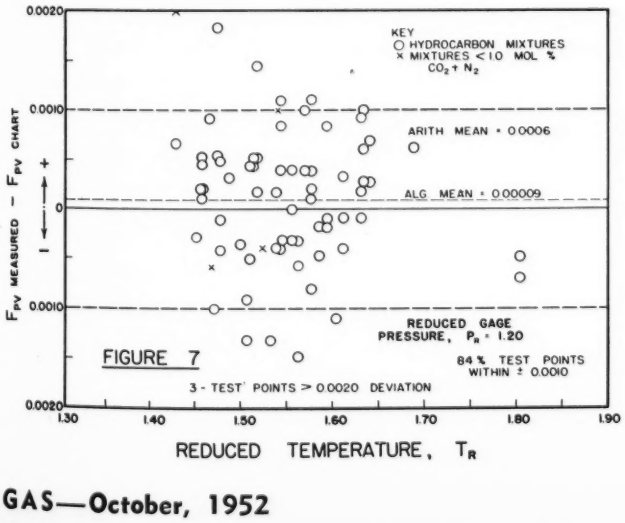

FIGURE 7

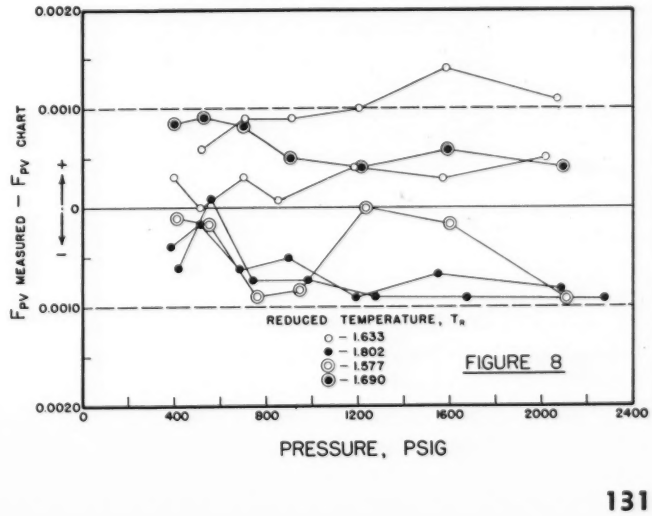

FIGURE 8

PRECISION BY THE

A Clark compressor on the job is your assurance of dependable performance. Unrivaled engineering and quality construction, literally precision by the ton, make this dependability possible. From massive crankcases to minute governor parts, unequaled precision standards are maintained to assure extra long compressor life

How are these standards achieved?

1. Clark insists on painstaking care, meticulous, accurate machining of *all* parts affecting the performance and life of the compressor — *no matter what the size or what the function.*
2. Clark has the specialized tools and equipment to produce to unsurpassed, uniformly high precision standards. To meet these standards, Clark has had to build many of its own specialized tools.
3. Clark has the specialized know-how, the skill, the craftsmen. A half century has been devoted solely to designing and precision-building heavy duty compressors for every conceivable need.

The Clark trademark on a compressor is your assurance of extremely long life.

SETTING THE PACE IN PRECISION STANDARDS

CLARK® compressors

CLARK BROS. CO. Division of Dresser Operations, Inc. OLEAN, N. Y.

OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

Gas-Engine-Driven • Steam-Engine-Driven • Motor-Driven • Centrifugal

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Final inspection of power piston before lubrizing.

Table 5. Breakdown of Higher Hydrocarbon Fractions

Per cent by volume of hydrocarbon fractions only.

Constituent Content, %	Ethane Per Cent Samples	Propane Per Cent Samples	Butanes and Higher Per Cent Samples
0 to 1.0	8	40	52
1.0 to 2.0	8	35	36
2.0 to 3.0	12	14	9
3.0 to 4.0	31	7	3
4.0 to 5.0	19	4	
5.0 to 6.0	16	Ave. % ethane.....3.70	
6.0 to 7.0	4	Ave. % propane.....1.45	
7.0 to 8.0	2	Ave. % butanes and higher..1.05	

Table 6. Critical Temperatures and Pressures of Hydrocarbon Components Used in Calculating Pseudo-Critical Temperatures and Pressures of Natural Gas Mixtures

Component	Molecular Weight	Critical Temperature Deg. R.	Critical Pressure Psia
Methane	16.04	344	673
Ethane	30.07	595	712
Propane	44.09	666	617
Iso-butane	58.12	734	529
N-butane	58.12	766	551
Iso-pentane	72.15	830	483
N-pentane	72.15	846	485
Hexanes	86.17	911	440
Heptanes p us	110.0	1100	400

Fig. 2 shows the pseudo-critical temperature of the gas samples plotted in terms of the specific gravity, with both coordinates expressed on a pure hydrocarbon basis. The pseudo-critical temperatures were calculated directly from the fractional analyses of the gas samples using values of the critical temperatures of the various hydrocarbon fractions as shown in *Table 6*. The critical temperature of ethane has been adjusted from the standard value of 550° Rankine to 595° Rankine. This adjusted value of the critical temperature of ethane was arrived at by comparison of the experimental data on the supercompressibility factor with those for methane. The straight line shown in *Fig. 2* is given by

$$\Theta_h = 157.5 + 336.6\,G_h \qquad (4)$$

A plot of the calculated hydrocarbon critical pressures versus hydrocarbon specific gravity is shown in *Fig. 3*. The critical pressures of the hydrocarbon components used in calculating the pseudo-critical pressures of the mixtures of hydrocarbons are the standard values listed in *Table 6*. The straight line used to represent the variation of pseudo-critical pressure with specific gravity is

$$\pi_h = 690 - 31\,G_h \qquad (5)$$

In order that the compressibility data of methane, expressed in terms of reduced coordinates, apply to mixtures containing carbon dioxide and nitrogen it is necessary to use adjusted values of their critical temperatures. The experimental data obtained to date in the test program containing appreciable quantities of these dilutents are too few in number to allow direct evaluation of the adjusted values. For this reason the adjusted values as given by Dunkle[6] are employed. They are:

$$\Theta_c = 510\ ^\circ R \text{ and } \Theta_n = 216\ ^\circ R$$

The critical pressures of carbon dioxide and nitrogen are taken equal to their standard values, 1072 psia and 492 psia.

By use of equations (1) through (5) and the relation between gravity of the mixture and the gravities of the hydrocarbon, carbon dioxide and nitrogen fractions, it is possible to show that the pseudo-critical temperature and pressure of a gas mixture are defined by the specific gravity, heating value and the carbon dioxide content of the mixture accord to the equations*

$$\Theta = 127 + 92.10\,G + 0.1642\,H + 243.2\,X_c \qquad (6)$$
$$\pi = 670.8 - 184.8\,G + 0.1033\,H + 681.9\,X_c \qquad (7)$$

In terms of the specific gravity and the carbon dioxide and nitrogen contents

$$\Theta = 157.5 + 336.6\,G - 158.5\,X_c - 267.0\,X_n \qquad (8)$$
$$\pi = 690.0 - 31.0\,G + 429.1\,X_c - 168.0\,X_n \qquad (9)$$

and in terms of the heating value and the carbon dioxide and nitrogen contents

$$\Theta = 115.0 + 0.2261H + 394.6\,X_c + 101.0\,X_n \qquad (10)$$
$$\pi = 693.9 - 0.02082H + 378.1\,X_c - 201.9\,X_n \qquad (11)$$

Or, in terms of the gravity, heating value and nitrogen content

$$\Theta = 145.4 + 240.2G + 0.06475H - 161.7\,X_n \qquad (12)$$
$$\pi = 722.6 + 230.0G - 0.1753H - 453.0\,X_n \qquad (13)$$

Either of the four sets of equations may be used to define the pseudo-critical temperature and pressure, and accordingly the reduced temperature and reduced gauge pressure for any known pressure and temperature of the gas mixture.

Supercompressibility Factors for Methane

Existing data on the compressibility factors of methane[7, 8, 9, 10] were used to prepare the basic working chart of supercompressibility factor F_{pv} as a function of reduced temperature T^R and reduced gauge pressure P^R. All data were converted to yield a supercompressibility factor of unity at a base pressure of 14.4 psia. A problem encountered in the preparation of these working data resulted from the fact that relatively low reduced temperatures must be included in order to make the data applicable to natural gas mixtures having high percentages of the higher hydrocarbons. Compressibility factors in the temperature range —60° F to 200° F are necessary for preparation of working data. A thorough study of the available data in the low temperature range shows appreciable inconsistency among various sources and, in consequence, the values chosen represent what appeared as a best average. Considerable weight was attached to values calculated from the Benedict equation of state[10]. Tests are presently being conducted to define F_{pv} for methane at low temperatures. Within the high temperature range, 40° F to 200° F, data from the various sources are in fairly good agreement; the data of Sage and Lacy[7] were used exclusively in the final definition of the supercompressibility factors in this temperature range. *Table 7* lists typical values of supercompressibility factor F_{pv} for methane.

*Reference 6 gives a complete derivation of these equations; it is not, therefore, repeated here.

Comparison of Predicted F_{pv} Factors With Experimentally Determined Data

Since specific gravity, carbon dioxide and nitrogen content were determined for each test sample, an evaluation of the accuracy of the working method may be made by comparing the F_{pv} factors determined by test with those derived from the basic methane data.

The results obtained from this comparison are given in *Figs. 4* through *10*. *Fig. 4* shows the supercompressibility factor F_{pv} as a function of reduced pressure for one temperature. The lines A, B and C define the values of F_{pv} derived from existing methods for predicting supercompressibility factors. The solid line marked "working method" defines the values derived from use of equations (6) and (7) and the basic methane data illustrated in *Table 7*. Agreement of

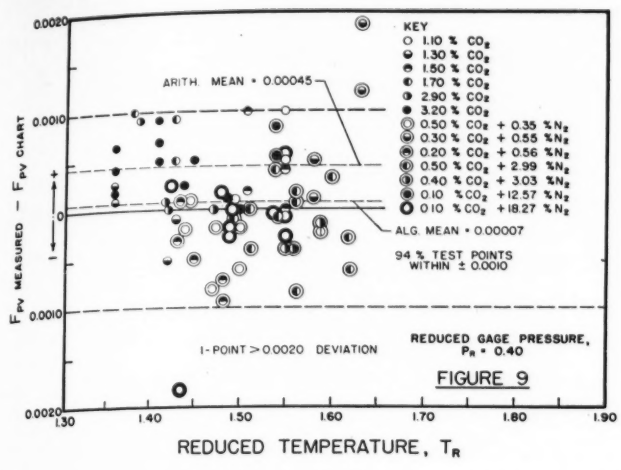

KEY
1.10 % CO2
1.30 % CO2
1.50 % CO2
1.70 % CO2
2.90 % CO2
3.20 % CO2
0.50 % CO2 + 0.35 % N2
0.30 % CO2 + 0.55 % N2
0.20 % CO2 + 0.56 % N2
0.50 % CO2 + 2.99 % N2
0.40 % CO2 + 3.03 % N2
0.10 % CO2 + 12.57 % N2
0.10 % CO2 + 18.27 % N2
ARITH. MEAN = 0.00045
ALG. MEAN = 0.00007
94 % TEST POINTS WITHIN ± 0.0010
1 - POINT > 0.0020 DEVIATION
REDUCED GAGE PRESSURE, PR = 0.40
FPV MEASURED − FPV CHART
REDUCED TEMPERATURE, TR

FIGURE 9

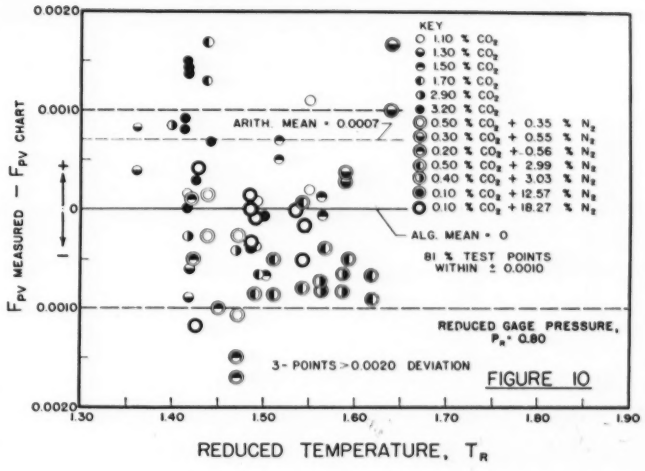

KEY
1.10 % CO2
1.30 % CO2
1.50 % CO2
1.70 % CO2
2.90 % CO2
3.20 % CO2
0.50 % CO2 + 0.35 % N2
0.30 % CO2 + 0.55 % N2
0.20 % CO2 + 0.56 % N2
0.50 % CO2 + 2.99 % N2
0.40 % CO2 + 3.03 % N2
0.10 % CO2 + 12.57 % N2
0.10 % CO2 + 18.27 % N2
ARITH. MEAN = 0.0007
ALG. MEAN = 0
81 % TEST POINTS WITHIN ± 0.0010
3 - POINTS > 0.0020 DEVIATION
REDUCED GAGE PRESSURE, PR = 0.80
FPV MEASURED − FPV CHART
REDUCED TEMPERATURE, TR

FIGURE 10

"working method" data with experimental data is within 0.10% over the entire pressure range.

Figs. 5, 6, and *7* summarize the difference between measured values of F_{pv} and the corresponding values derived from the working method. The reduced pressure P_R is constant for each plot, being equal to 0.40, 0.80 and 1.20 for *Figs. 5, 6,* and *7,* respectively. A study of the three plots shows no detectable difference between the pure hydrocarbon mixtures and those containing less than 1% carbon dioxide plus nitrogen. Hence, for comparison purposes the mixtures containing slight amounts of diluents may be included with the pure hydrocarbons. For the reduced pressure of 0.40 the algebraic mean deviation is roughly +0.0002, the arithmetic mean deviation 0.0005, and 89% of all test points have differences less than 0.0010 from the values obtained by the working method. At a reduced pressure of 0.80, *Fig. 6,* the algebraic mean deviation is about +0.00015, the arithmetic mean 0.0007, and 82% of all test points differ less than 0.0010 from the values obtained by the working method. Similar results are obtained for the reduced gauge pressure of 1.20, *Fig. 7*; here, the algebraic mean deviation is +0.0001, the arithmetic mean 0.0006 and 84% of all the points fall within the plus or minus 0.0010 range.

Fig. 8 gives the difference between the predicted values of F_{vp} and corresponding test data for six high pressure tests. The number of high pressure tests conducted to date are too few to conclusively check the accuracy of the working method at very high pressures, but, as may be seen from this plot, the trends of the difference curves do not suggest any fundamental inaccuracies in the working method.

A check on the validity of the working method when applied to mixtures containing the diluents carbon dioxide and nitrogen was made and the results for reduced gauge pressures of 0.40 and 0.80 are presented in *Figs. 9* and *10,* respectively. The maximum carbon dioxide content is 3.2% and the maximum nitrogen content is 18.27%. A study of the differences over this range of diluents indicates no particular trend with any variable, and it may be concluded that the differences can mostly be ascribed to experimental variations. Furthermore, it appears fairly conclusive that for the ranges of pressure and temperature studied, the adjusted values of the critical temperature of carbon dioxide and nitrogen as given by Dunkle are satisfactory.

In summary, it is believed that for the pressure range zero to roughly 1100 psia, the temperature range 40° F to 200° F, the specific gravity range 0.55 to roughly 0.75 and percentage diluents up to about 15 to 20, the working method very accurately predicts the magnitude of the supercompressibility factor F_{pv}; the average error is less than 0.10%.

A continuing test program is intended to furnish many high pressure data from which the validity of the present working method may be checked. In addition, a study of the deviations over wider ranges of specific gravity, diluents, temperatures, etc. will be made.

Table 7. Supercompressibility Factors F_{pv} for Pure Methane

Reduced Gauge Pressure P_R	Reduced Temperature, T_R								
	1.44	1.46	1.48	1.50	1.52	1.54	1.56	1.58	1.60
0.2	1.0112	1.0106	1.0100	1.0095	1.0090	1.0085	1.0082	1.0078	1.0074
0.4	1.0226	1.0214	1.0202	1.0191	1.0181	1.0171	1.0163	1.0155	1.0148
0.6	1.0342	1.0324	1.0306	1.0289	1.0275	1.0260	1.0245	1.0233	1.0221
0.8	1.0458	1.0433	1.0410	1.0388	1.0367	1.0348	1.0330	1.0312	1.0295
1.0	1.0573	1.0544	1.0515	1.0487	1.0461	1.0437	1.0414	1.0392	1.0371
1.2	1.0696	1.0656	1.0618	1.0583	1.0550	1.0520	1.0492	1.0465	1.0441
1.4	1.0816	1.0768	1.0723	1.0680	1.0640	1.0605	1.0570	1.0539	1.0510
1.6	1.0932	1.0874	1.0820	1.0771	1.0725	1.0684	1.0644	1.0607	1.0574
1.8	1.1045	1.0977	1.0915	1.0859	1.0808	1.0710	1.0716	1.0674	1.0635
2.0	1.1153	1.1078	1.1010	1.0947	1.0890	1.0836	1.0786	1.0740	1.0695
2.2	1.1250	1.1168	1.1094	1.1025	1.0960	1.0901	1.0846	1.0795	1.0748
2.4	1.1340	1.1250	1.1172	1.1099	1.1032	1.0969	1.0908	1.0850	1.0798
2.6	1.1414	1.1321	1.1236	1.1158	1.1088	1.1020	1.0957	1.0898	1.0842
2.8	1.1475	1.1376	1.1288	1.1206	1.1132	1.1061	1.0996	1.0935	1.0877
3.0	1.1521	1.1412	1.1322	1.1238	1.1164	1.1092	1.1024	1.0961	1.0901

The research program herein reported was sponsored during 1951 by the Tennessee Gas Transmission Co. and the Columbia Gas System Service Corp., and in 1952 by Tennessee, Columbia and the Lone Star Gas Co., acting as a joint sponsoring agency. The authors wish to extend appreciation to E. S. Plank of the Tennessee Gas Transmission Co. and J. E. Overbeck and H. B. McNichols of the Columbia Gas System Corp. for their cooperation in providing test data and for their willingness to help in carrying out this program.

REFERENCES

1. "Compressibility Determinations Without Volume Measurements," by E. S. Burnett, *Journal of Applied Mechanics,* Trans. ASME, Vol. 3, December, 1936, p. A-136.

2. "A Comparison of the Bean and Burnett Apparatus for Measuring Gas Law Deviation Factors," by O. T. Bloomer, American Gas Assn., New York, N. Y., p. C-51-14, May, 1951.

3. "Tentative Standard Method for Calculation of High Pressure Gas Measurements," Natural Gasoline Assn. of America, Tulsa, Okla., Standard 4142, December, 1942.

4. "Tentative Standard Procedure for the Determination of Superexpansibility and Manometer Factors Used in Measurement of Natural Gas by Orifice Meter at Pressures in Excess of 500 Psig," California Natural Gasoline Assn., Los Angeles, Bulletin No. TS-461, 1947.

5. "Tentative Standards for the Determination of Superexpansibility Factors in High Pressure Gas Measurement," California Natural Gasoline Assn., Los Angeles, Bulletin No. TS-354, 1936.

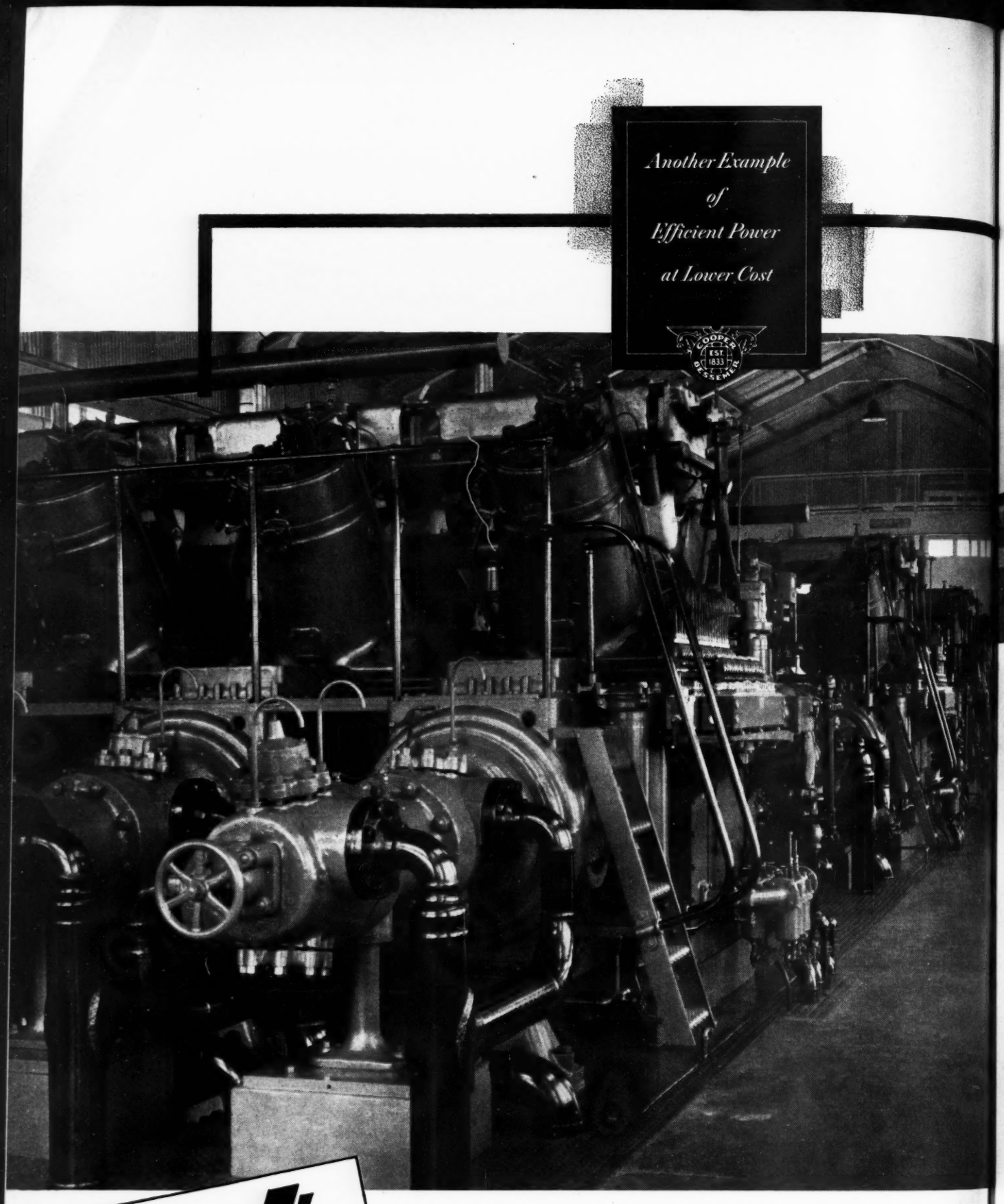
6. "The Pseudo-Critical Method for Evaluating Deviation of Natural Gas from Boyle's Law," by R. V. Dunkle, *GAS,* October, 1944, p. 41.

7. "Thermodynamic Properties of the Lighter Paraffin Hydrocarbons and Nitrogen," by Bruce H. Sage and William N. Lacey, American Petroleum Institute, New York, N. Y., 1950.

8. "Thermodynamic Properties of Methane at Low Temperature," by Corcoran, Bowles, Sage and Lacey, *Industrial and Engineering Chemistry,* Vol. 37, 1945, p. 825.

9. "Volumetric Behavior of Methane," by Olds, Reamer, Sage and Lacey, *Industrial and Engineering Chemistry,* Vol. 35, 1943, p. 922.

10. "Liquid-Vapor Equilibrium in Methane-Ethylene-Isobutane System," Manson Benedict, Ernest Soloman and Louis Rubin, *Industrial and Engineering Chemistry,* Vol. 37, p. 55, January, 1945.



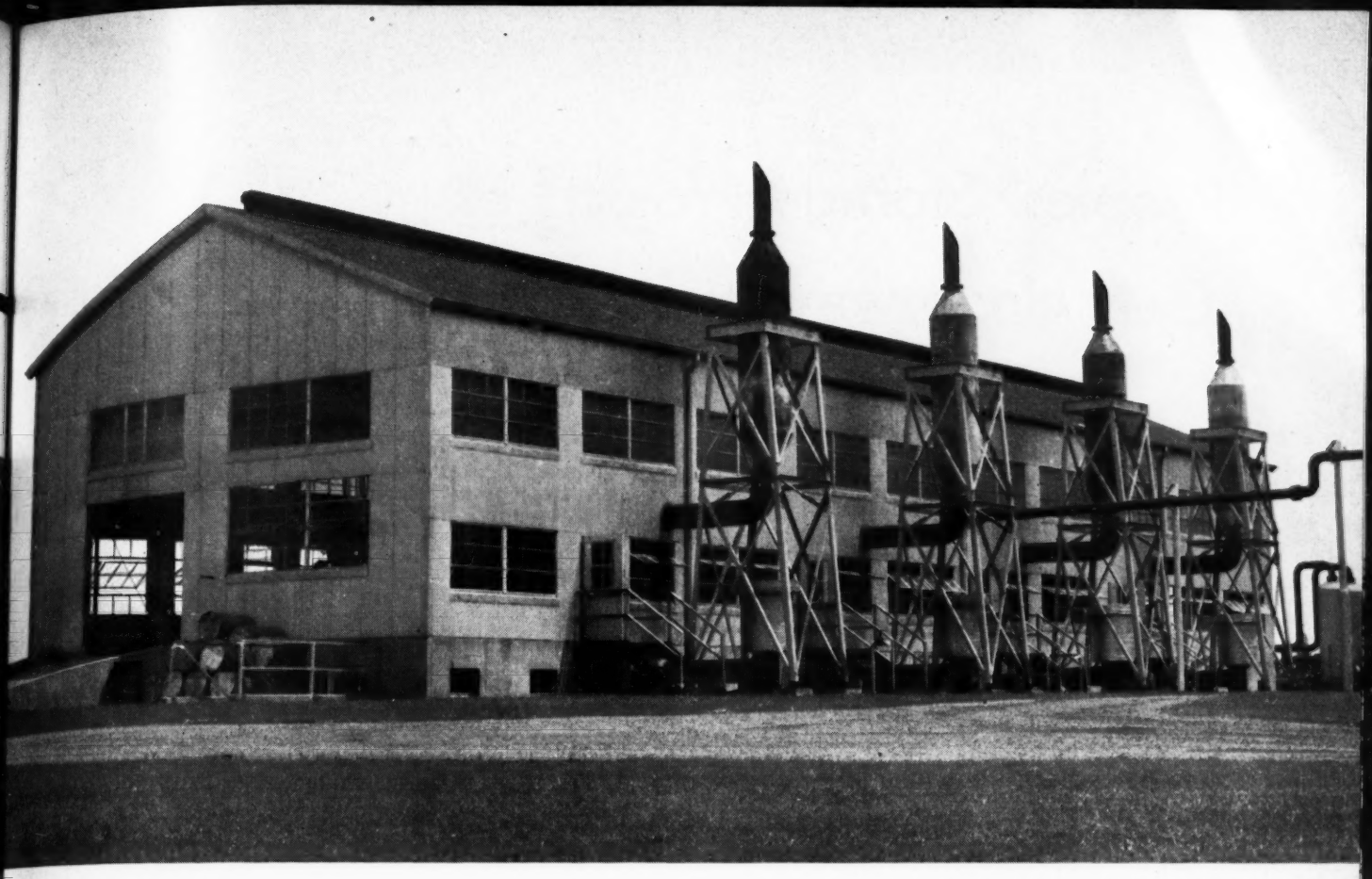
Line-up of four Cooper-Bessemer GMV, 10-cylinder, 1100 hp V-angle compressors installed in The East Ohio Gas Company's Robinson Station near North Canton, Ohio. Units compress gas from 400 pounds suction to 1,180 pounds discharge for underground storage and transmission to the company's marketing areas.

V ANGLE

Compressors

New York Washington, D. C. Bradford, Pa. Parkersburg, W. Va

San Francisco, Cal. Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle, Wash



Cooper-Bessemer GMV'S
help East Ohio Gas put on the pressure!

The East Ohio Gas Company reports excellent low cost service and exceptional fuel economy from their 4-unit installation of GMV compressors at the Robinson Station, shown above. Here, gas from the Big Inch and West Virginia fields is either compressed for underground storage or further boosted in pressure to supply gas to the industrial Cleveland, Akron, Canton, and Youngstown areas.

During extreme cold weather peaks when the pipe line supply is insufficient, the gas is withdrawn from storage and boosted on to the same industrial areas.

The four GMV's installed in 1949 are 10-cylinder, 1100 hp turboflow units each with 5 compressor cylinders. The unique cylinder arrangement, utilizing each crankthrow, permits the engines to do three jobs at full load, boosting to market, pumping into storage, withdrawing from storage. Some 60 million cubic feet of gas is handled daily, from approximately 400 pounds suction to 1,180 pounds discharge.

Whether your plans call for complex compressor service, or the simplest kind of setup, you'll be ahead with Cooper-Bessemer V-angles. Check with the nearest Cooper-Bessemer office for the latest details.

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MOUNT VERNON, OHIO AND GROVE CITY, PENNA.

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Peoples' Storage Project Gets Underway at Last

By JAMES F. OATES
Chairman, Peoples Gas
Chicago

FPC Approves Storage Project

WASHINGTON, D.C., September 11, 1952—The Federal Power Commission has approved the first stage of the development of an underground storage area for natural gas near Herscher in Kankakee and Iroquois counties, Illinois, by Natural Gas Storage Co. of Illinois, of Chicago.

The project, which is estimated to cost initially $17 million, will be used to store natural gas for the account of Natural Gas Pipeline Co. of America and Texas Illinois Natural Gas Pipeline Co., both of Chicago. The three companies are subsidiaries of Peoples Gas Light & Coke Co., also of Chicago.

THE ABOVE FPC ACTION MARKS THE end of a long series of obstacles to the completion of the now famous Herscher underground storage project. Most of the technological problems and their solutions are described in the following article by Mr. Oates but there were other delays too. To secure rights to the land, Peoples had to wait for the Illinois legislature to enact a law giving qualified utilities the right of eminent domain for storage fields and then had to secure approval from the state commerce commission. Then they were further delayed by the steel strike, negotiations with landowners, and the necessity for securing FPC approval. Final approval still has not been given for the entire project but at last the work can get under way and the field will go into operation next year.

The storage company plans to develop the project over a five-year period . . . The initial project includes the drilling of 25 wells and the construction of 16.7 miles of 30-in. pipeline to transport gas to storage during summer and from storage during winter. The project, in its first stage, also will include a 10,000 hp compressor station, a dehydration plant, approximately 8.76 miles of well lines, 25 well meters, one main storage meter, and other auxiliary and appurtenant facilities . . . The FPC's order specifies that the authorization covers only the first stage of the development and that no subsequent stage of development shall be undertaken without commission authorization.

The speech from which this article was taken was made by Mr. Oates at the Centennial of Engineering convocation in Chicago last month before FPC approval of the project had been announced. In it, he covers mainly the technical aspects of the project. For background and further details see *GAS,* Dec. 1951, p. 101 for "The Herscher Gas Storage Project" by J. J. Hendrick; p. 97, Nov. 1951 for "Storing Gas in Underground Water Sands" by Ionel I. Gardescu; and p. 100, Jan. 1952, p. 89, Dec. 1950, and p. 92, Oct. 1949 for news items.

* * *

AT full operation, the Herscher field is expected to be capable of delivering a very impressive peak-day maximum of 1500 MMcf of gas from storage. Such a maximum delivery from storage, when combined with the delivery of our system's three long distance pipelines, will make available to the consuming public on peak days a volume which would be about two and one-half times the amount of gas which the Texas-to-Chicago region pipelines could deliver without the storage field's help. Together, the long distance lines of Natural Gas Pipeline Co. of America and Texas Illinois Natural Gas Pipeline Co., both subsidiaries of Peoples Gas, now have a daily transmission capacity of 906 MMcf.

It is estimated that for initial operation, the project will cost approximately $17 million and that an investment of about $50 million will be required to bring the field up to full production. At top capacity it will match the effectiveness, from the standpoint of peak-day deliverability, of three new major pipeline systems which would cost more than $550 million to build. Any such investment would be highly questionable, of course, because it would require the customer to pay a prohibitive price for every therm of heating gas he might use.

Plans call for the first gas to be injected in the summer of 1953, and for some gas to be withdrawn for use in the heating season of 1953-1954. We plan, in the first year, to drill 25 wells into the Galesville bed for both injection and delivery of gas. An ultimate battery of 50 such wells is expected to be sufficient when the field reaches maximum operation. Wells will be completed with strings of 8⅝-in. diameter steel casing, with larger pipe used to protect fresh water horizons in the upper formations. All casing will be cemented from top to bottom so fresh water sands and all other porous zones will be properly protected.

There will also be installed a system of gathering lines connected to a centrally located compressor station and dehydration plant. The dehydration plant will be necessary because the gas, even though dry when injected, will be in contact with water in the reservoir and must be dried when withdrawn for use. Compressor station piping will be installed so the station can pump gas into storage or from storage to the pipelines.

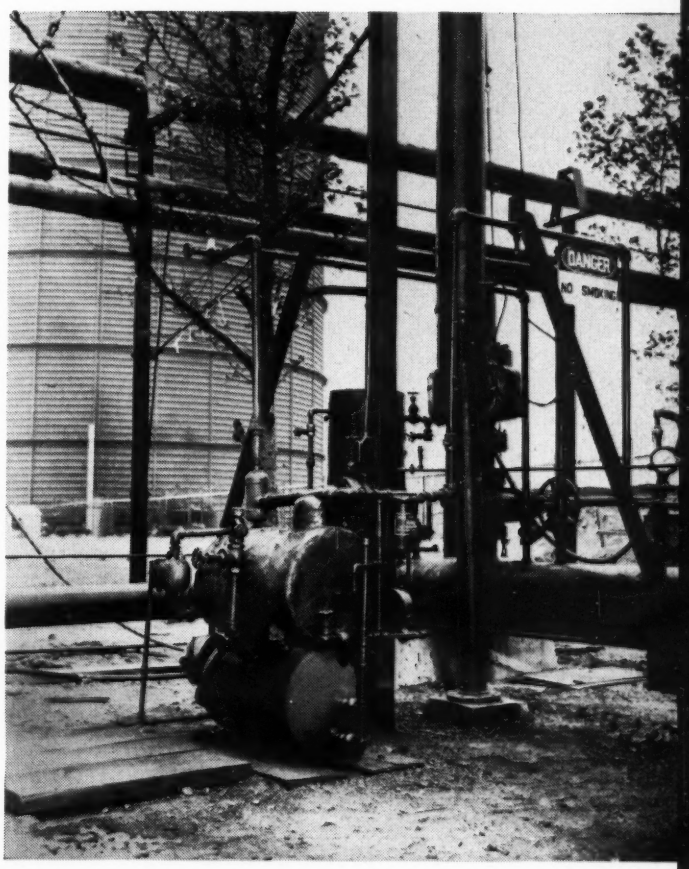
For the first phases of the field's operation, the compressor station will be powered by five 2000-hp gas-driven compressor engines, and its design will permit the addition of more compressors as the demand for storage gas increases.

Among the first installations will be a 30-in. diameter transmission line, 17 miles long, to feed natural gas from the main line of the Texas Illinois pipeline system to the storage field. Although this line will be used to transmit gas both into and out of storage in the first year,

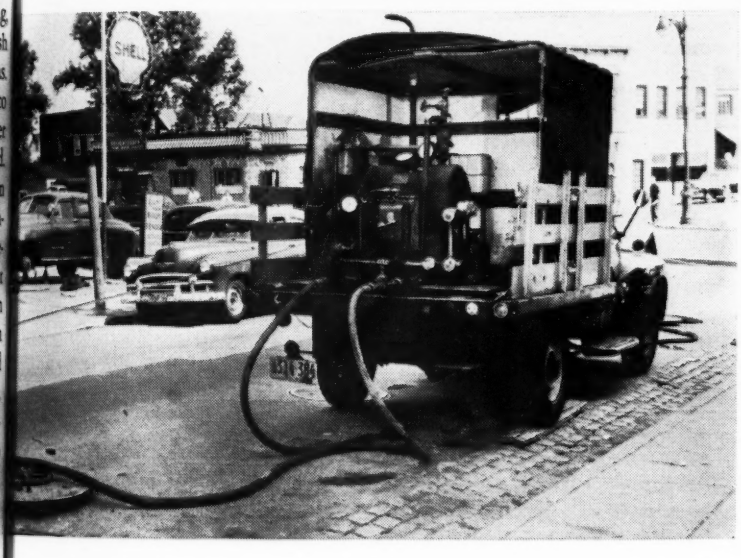
Fogger Plays Important Role Gas Conversion Job...

BROOKLYN UNION GAS COMPANY

has completed—on schedule—the stupendous task of supplying their 950,000 domestic, commercial and industrial customers with natural gas. The change-over was accomplished with a minimum of inconvenience to practically the entire population of Brooklyn and Queens. Before and during this conversion Blaw-Knox Electroil Foggers were put "on stream" at strategic points to condition both the gas and the distributing facilities . . . A report from the engineer in charge expresses his complete satisfaction with the performance of the Oil Foggers and their value to both the Company and its customers . . . For comprehensive data on Electroil and Portable types *write for Bulletin No. 2353.*



ABOVE . . . Portable Oil Fogger at accumulator station.



LEFT . . . Truck-mounted Portable Fogger in use during change-over.

Gas Equipment Department

BLAW-KNOX DIVISION OF BLAW-KNOX COMPANY

2033 FARMERS BANK BLDG., PITTSBURGH 22, PA.

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it will be used only to feed gas into storage after another 30-in. line is built from the field to Joliet to carry gas out of storage to the pipeline terminals. We plan to build the Herscher-to-Joliet outgoing line in 1954, and it is anticipated that later we will require a second 30-in. pipeline from the field to Joliet, or to some other point in the market area.

Our search for a large-scale storage facility began several years ago, and all possible methods were carefully studied in the light of our system's needs. It was determined that our integrated system would require a facility having an ultimate capacity of 90 billion cu ft of useful storage and this figure has remained as our objective.

As the search proceeded, it became increasingly evident that the best possibility, if sufficient storage volume were to be realized in a satisfactory location and within reasonable time, lay in developing one of the very few large geologic domes in this region of the Middle West.

Of the several possible locations, the anticline underlying nearby Herscher appeared to hold the most promise because of its nearness to our natural gas pipeline terminals at Joliet, and the principal market area. Chicago's city limits lay just 55 miles away, to the north and east of the formation. Terminals of the three long distance pipelines were only 44 miles to the north.

As the need for large-volume storage became more urgent, studies were begun to determine the advisability of developing our field within Herscher Dome. Our first objective was to learn if the anticline contained a geologic trap which was suitable for a large-capacity gas reservoir. To have the benefit of expert advice and assistance in this specialized field of geology, the services of eminent oil and gas consultants were engaged.

We knew the anticline was there. And studies made of all the available geologic data showed that at a depth of 1600 ft or more lay a reasonably thick stratum of porous sandstone. What we had to determine was whether that bed of sandstone known as the Galesville formation, had the proper characteristics to be converted into a storage field capable of holding enough gas for our needs.

The data showed that a shallow bed of Galena dolomite lay at depths of from 150 ft to 500 ft from the surface and that the contour of that formation followed that of the all-important Galesville sandstone. Thus the Galena formation was chosen as a marker horizon for the next phase of the program.

Water well drilling equipment was used to bore 104 test holes to the top of the marker formation within an area of 30 sq miles. These data, together with that yielded by 100 seismographic stations, were used by the geologists to contour map the surface of the Galena.

By this means our research men determined that the closure of the lower Galesville formation would be about 200 ft, a very adequate closure, and that the area of the trap encompassed almost 25 sq miles. This was almost conclusive evidence that the required structure was present within Herscher Dome.

For the next step in the engineering program it was necessary to test the reservoir bed and the overlying cap-rock to determine their position, content, porosity, permeability, and the nature of the fluid within several strata. For this purpose, five test wells were drilled into and through the storage formation to depths of 2000 ft. Porosity and permeability tests, both horizontal and vertical, were taken at 2-ft intervals along each well down to the base of the Galesville sand.

In the course of the drilling, electric logging surveys of open holes below the surface casings were made to obtain geological and geophysical information of the several formations penetrated. What was revealed by these studies served to support our most optimistic hopes.

They showed the structure at Herscher to be a closed anticline, a giant dome nearly 15,000 acres in extent, containing a reservoir of highly porous and permeable sandstone 100 ft thick and one-third of a mile below ground.

The reservoir formation is filled with a salty artesian water which is under a normal hydrostatic pressure of slightly more than 700 psi. When gas is injected into the top of the reservoir bed at pressures not to exceed 1000 psi, the water will be forced back along the perimeter of the region in which the gas is being stored (the gas "bubble"), forming a lateral seal to prevent the gas from meandering from its trap.

At the crest of the dome the Galesville sandstone bed lies 1750 ft beneath the earth's surface. An impervious caprock 123 ft thick lies immediately above the reservoir to seal the storage zone against any possible upward travel of the gas. Directly beneath the storage stratum is an impervious black shale, which likewise will serve as a seal to contain the gas. Average effective porosity is about 25%, which is above average for oil and gas fields. The permeability is higher than that in any storage field for which the geologists have data.

It is an aquifer of almost ideal characteristics and capacity. Indications are it will have an effective storage capacity that will prove larger than any storage field now in use, and a deliverability, the capacity to yield up the gas once it has been placed in storage, that will be higher than that of any field in operation.

We are counting on the reservoir ultimately holding, in addition to an as yet undetermined volume of "cushion" gas, at least 90,000 MMcf of gas which may be withdrawn as needed. Just for purposes of comparison, the Chicago customers of Peoples Gas in one year use the equivalent of slightly more than 100,000 MMcf of 1000 Btu natural gas. Our engineers have estimated that we might possibly require as much as 90,000 MMcf of cushion gas.

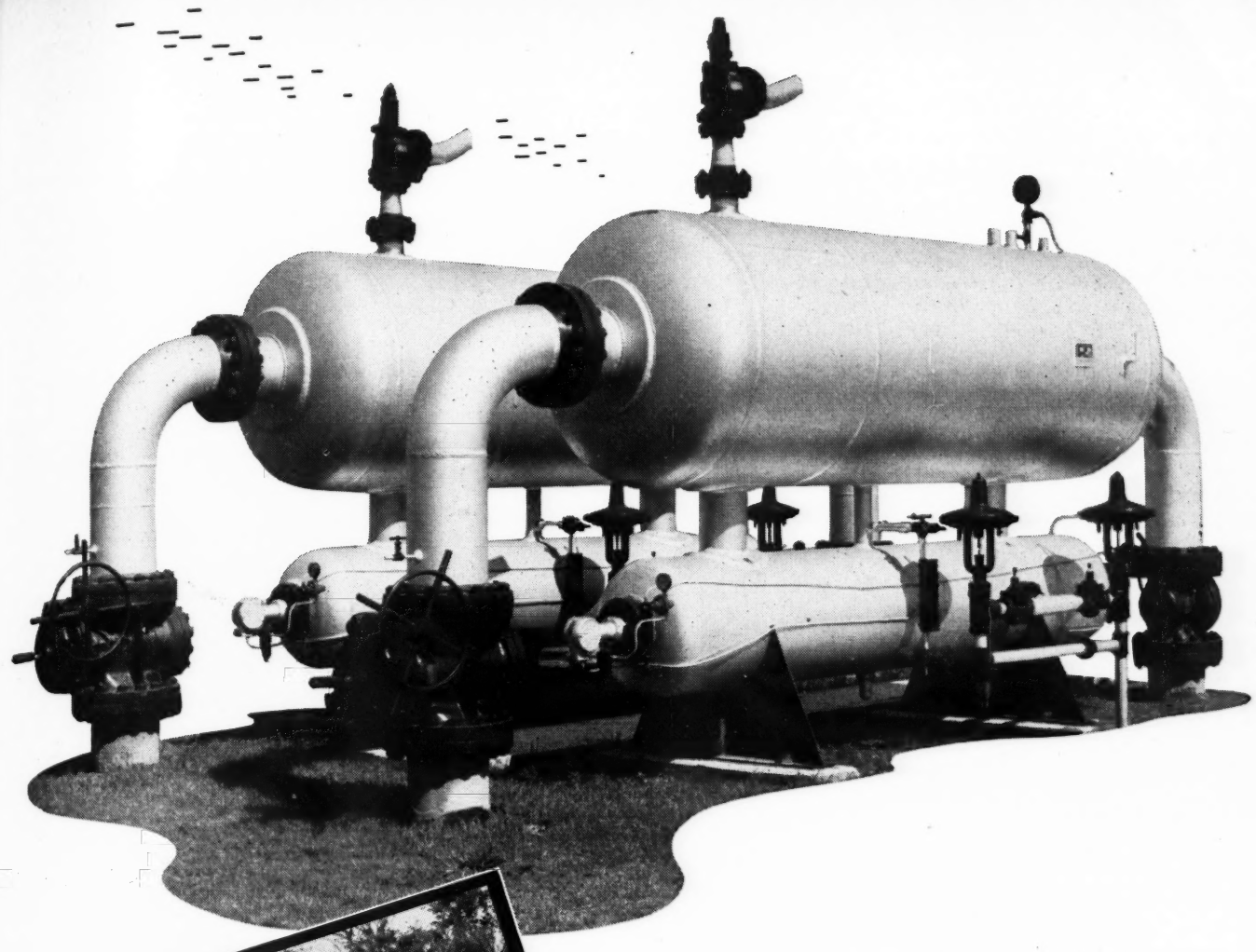
This particular geologic formation is within an area of pronounced anticline, or domed strata, situated in western Kankakee and northern Iroquois counties, in Illinois. There stratum upon stratum have been arched up in a nearly parallel and almost uniform manner to form what we consider to be an ideal geologic trap for the storage of gas. The anticline extends approximately eight miles in a north and south direction and two and one-half miles across. Broadly speaking, the proportions of this almost oval formation would resemble a giant meat platter turned upside down.

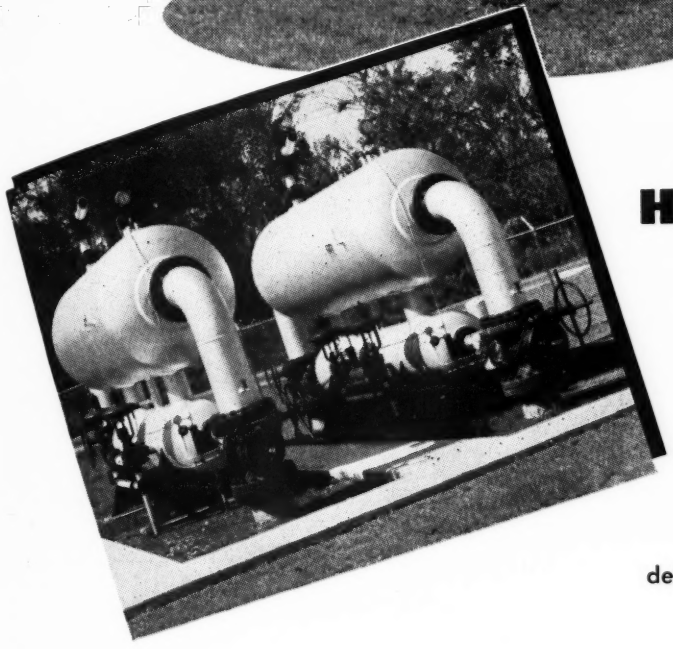
To us it has come to be known, somewhat affectionately, as Herscher Dome. It was so named because the crest of the dome lies near the outskirts of Herscher, a small town in a farming area which is part of the Chicago milk shed.

Storage of gas in aquifers (strata filled with water) is a tried and proven method. In many depleted gas fields converted for storage purposes, water had filled part of the reservoir areas as the original gas was withdrawn, and later it was successfully driven back as storage gas was injected into the reservoirs.

In at least three cases, gas has been injected into and successfully stored in aquifers that had not previously held natural deposits of gas. One is the East Hastings field of Texas, into which Stanolind Oil & Gas Co. injected 11,000 MMcf of gas.

The others are in the Doe Run and Muldraugh fields of Kentucky, where the Louisville Gas & Electric Co. for years has been storing quantities of gas in reservoir beds formerly filled with water and withdrawing the gas to meet its customers' peak-day demands.





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These two 48" x 10' x 500# WP National Horizontal Gas Scrubbers are installed at the Westwego station of the world's largest handler of natural gas. They are efficiently and economically removing liquids, both water and hydrocarbons, to assure the delivery of clean, dry gas to consumers in the New Orleans area. National Horizontal Gas Scrubbers are available in a wide range of sizes, working pressures and capacities to fit the needs of gas producers and carriers.

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Gas Pressure Regulation And Safety Control

By HOWARD EVANS

This is the second part of a two part article dealing with regulators. This section covers pipeline and town border regulators. For the first part, which concerns low-pressure distribution and house service regulators, see Page 66.

PRESSURES in large transmission lines usually vary from 300 to 1000 psi. These pressures are maintained by the compressor stations and will vary at any point in the line depending on the rate of flow and the distance from the compressors. Lateral lines leading from this main line to towns are usually operated at somewhat reduced pressure. These relatively short lines from the transmission lines to the town border regulator station are usually built with sufficient strength to take the maximum transmission pipeline pressure.

Exclusive

A regulator used for feeding these lines should normally be of such a design that any mechanical failure of the regulator would result in the regulator opening wide. A regulator which closed would in this case be a hazard because a temporary stoppage of gas supply would shut off the gas both on intermediate farm tap connections and the town distribution system itself, and there is always a tremendous problem in restoring service, as well as the constant risk that all pilots, etc., on customers' premises may not be turned off before gas pressure is restored.

Most large balanced valve type regulators can be furnished with various types of loading heads for regulating the gas pressure in lines feeding from the transmission lines. General practice is to utilize the instrument loading head for outlet pressures in excess of 300 psi. The main regulator should be of the cast steel design which can operate on inlet pressures up to 1200 psi. These regulators are normally furnished with ASA 600-lb flanges and with semi-steel valves and seats. In general, it is not feasible to use soft seat valves on the pressure drops encountered in this type of service.

For outlet pressures below 300 psi a power pilot loading system is recommended. In the Rockwell balanced valve regulator design, the instrument and pilot loading systems are used on an identical body and valve assembly which simplifies changing from one system to the other. Careful consideration of characteristics of both of these systems should be made to forecast the results of any possible mechanical failure.

Space does not permit a complete description of the operation of the instrument control but it can operate a large regulator with the valves either closing downward or upward. The two most likely mechanical failures in such a control are the loss of supply pressure and failure of the main diaphragm. In either case, the spring would lift the valves. Since it is desired in most cases that any possible failure be with the valves open, the proper selection of the regulator is usually one in which valves close downward *(Fig. 1)*.

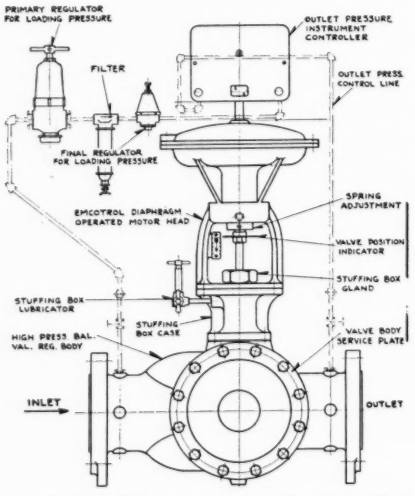


Fig. 1. The Emco valve regulator with instrument controller.

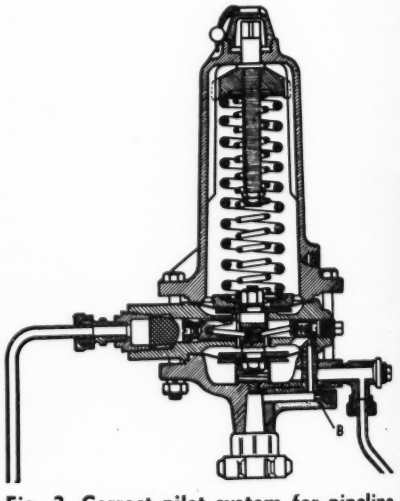


Fig. 2. Correct pilot system for pipeline laterals with bleed to the atmosphere.

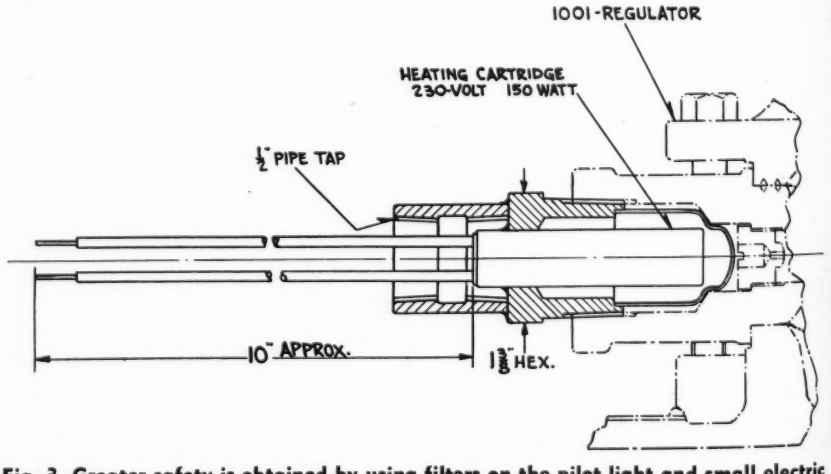
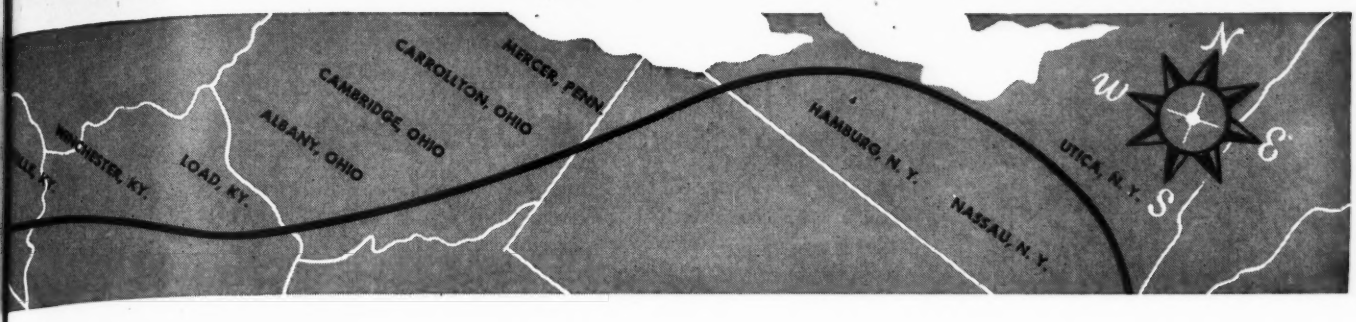


Fig. 3. Greater safety is obtained by using filters on the pilot light and small electric heaters in the pilot regulator.



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46 Worthington UTC Engine Compressors help pump 1,250,000,000 cu ft a day

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At last report, more than 1,250,000,000 cu ft of gas was being sent through the line daily. A total of 46 Worthington UTC engine compressors are now installed at eight different compressor station locations.

All these UTC units use the Worthington *Uniflo timed-scavenging method*—one big reason for the smooth performance they give. Uniflo scavenging assures a "clean sweep" of burned gases.

While built primarily for pipeline gas compression, the UTC is ideal for many other jobs such as: pressure maintenance on oil wells; varied service in natural gasoline plants; on solvent extraction, vapor recovery, recycling and stabilization of gases in oil refineries; in petro-chemical processing of products made from natural gas under pressure; and in many refrigeration applications.

If your process requires gas compression and you have a suitable gas available for fuel, the Worthington Uniflo UTC can do the best possible job for you.

Sizes range from 1,000 to 2,000 hp. For further information, contact the nearest Worthington District Office or write for Bulletin S-500-B23B.

Worthington Corporation, Engine Division, Buffalo, N. Y.

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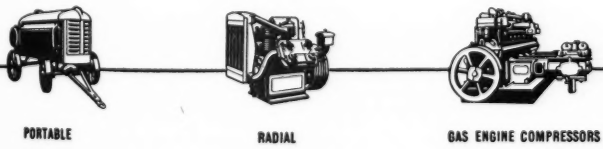


OUTPERFORM A WORTHINGTON

WORTHINGTON

Engine Compressors

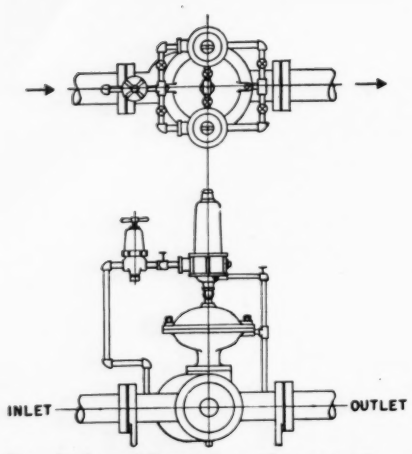


Fig. 4. An additional regulator, such as the PR, used ahead of the power pilot regulator reduces pressure drop across each pilot regulator.

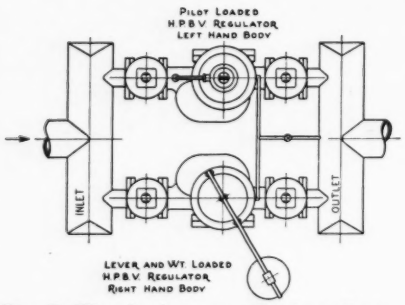


Fig. 5. The dual, or parallel installation of regulators.

The typical power pilot loading system has a spring holding the valves closed with the pilot bleed back of the outlet line. This would cause the main regulator to close in case of loss of loading pressure or diaphragm breakage. Since it is usually more desirable in pipeline laterals that the valves fail to the open position, the correct pilot system should not include a spring underneath the diaphragm, in which case the pilot bleed must be made to the atmosphere. See *Fig. 2.*

When using a pilot loading type of regulator the most normal problems are clogging of the valves in the pilot regulator with pipe scale or by freezing hydrates. Greater safety can be obtained by the use of filters on the pilot line and small electric heaters installed in the pilot regulator. As an additional safeguard against the pilot regulator clogging, it is often desirable to use two pilot regulators hooked up in parallel with one set at a slightly lower pressure *(Fig. 3).* If the primary pilot regulator should become clogged, the other pilot regulator will maintain the outlet pressure at a slightly lower pressure. An additional regulator, such as the PR regulator, can be used ahead of the power pilot regulators to reduce the amount of pressure drop across each pilot regulator. This reduces the chances of freezing and also sets an upper pressure limit if the seats in the pilot regulator should become damaged and fail to shut off *(Fig. 4).*

One of the best methods of regulator installations used to insure maintenance of pressure control is the dual or parallel

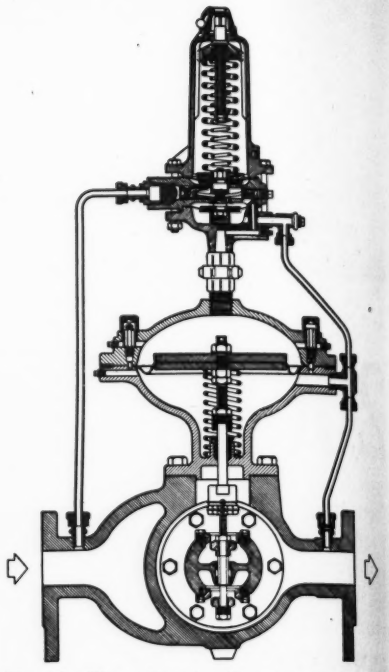
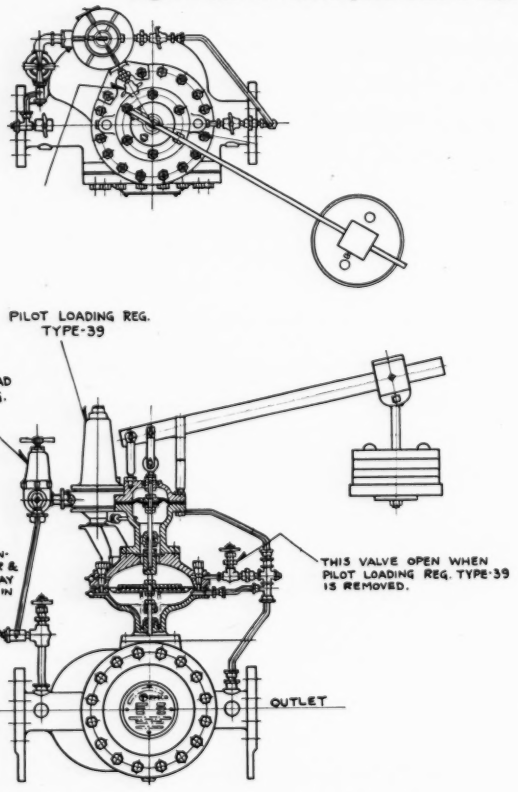
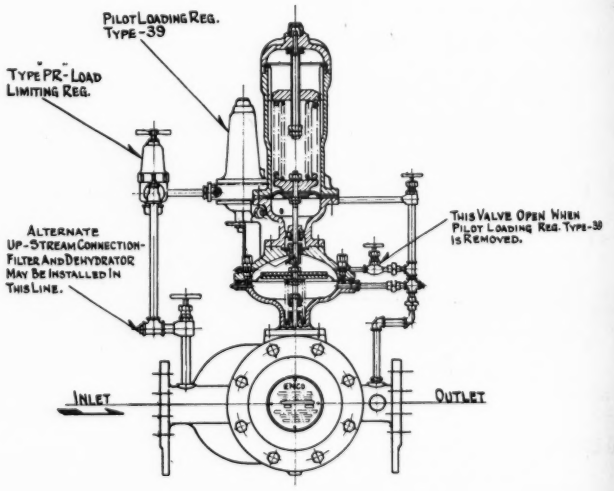


Fig. 8. The pilot loading system, with spring underneath the diaphragm, permits bleeding pilot regulator back to the outlet line.

installation of regulators *(Fig. 5).* Normally the load is carried by the pilot loaded or instrument loaded regulator. The weight and lever type high pressure balanced valve regulator would be set at a slightly lower pressure and remain closed. In case the outlet pressure drops, the weight and lever regulator will take over the load. Although this standby

Figs. 6 and 7. Power pilot loaded regulators with auxiliary weight and lever control.





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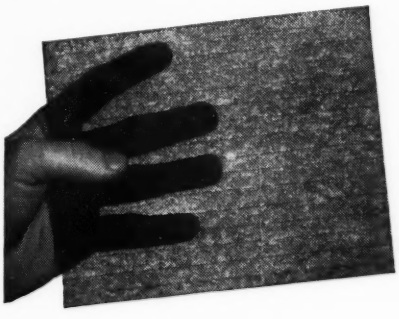

When you visit the Owens-Corning exhibit, see for yourself how the parallel reinforcement of Fiberglas Coromat assures superior tension and tear strength for fast, break-free wrapping. Notice how the fibers are uniformly distributed to provide even bleed-through, controlled porosity, consistent enamel thickness.

Take a look, too, at samples of Fiberglas Outer Wrap. Made with an inorganic core of Coromat, it protects the corrosion protection, cushions backfill impact, soil stresses and bumps. No wicking action to draw off rich protective oils or absorb moisture.

Remember, the best aid to corrosion protection is *glass* . . . and for the best in glass, see *Fiberglas.*

SEE WHY GLASS DEPENDS ON GAS

Did you know that the glass industry is one of the largest consumers of gas? Like other glass products, Fiberglas materials get their start in huge gas-fired batch furnaces. See the Owens-Corning exhibit for interesting facts on how we use gas to make glass . . . and in turn, how fibrous glass goes back to work for gas.

Whether you're concerned with gas transmission or gas merchandising, be sure to visit the Owens-Corning Fiberglas exhibit, Booths 729-732, when you come to the AGA Convention. You'll get a new insight into the profit possibilities of *gas* and *glass.*

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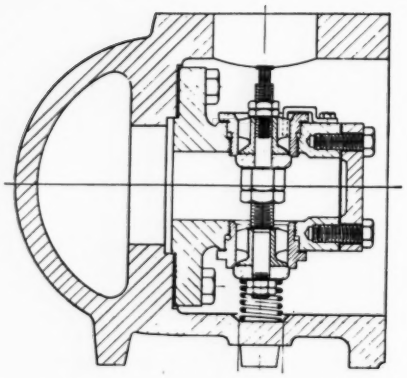


Fig. 9. With the spring to counterbalance the valve assembly, the vibrating or pulsating regulator would not fail open after the stem was cut off and proper repairs could be made easily.

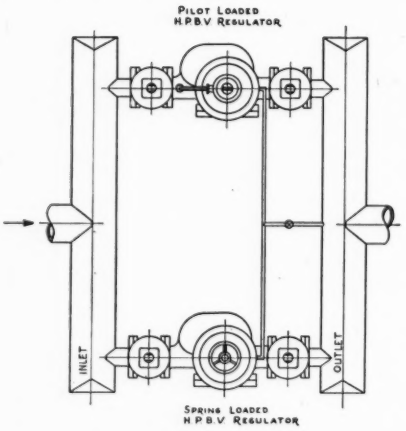


Fig. 10. A typical parallel regulator installation with standby regulator set for lower outlet pressure.

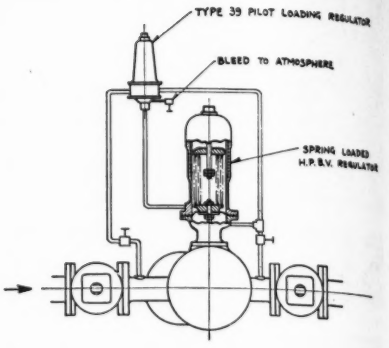


Fig. 11. A spring-loaded pilot-loaded regulator.

regulator will not hold as accurate an outlet pressure, it will insure maintenance of service. The illustration shows the two regulators back to back so as to minimize the installation space and still have easy accessibility to the valve bowl through the handhole plate. The Rockwell high pressure balanced valve regulators are usually built with the handhole plate on the right hand side when viewing the regulator from the inlet, but left-hand bodies, as illustrated, can be supplied in all sizes for dual installations.

Town Border Regulators

At town border stations, regulators are used to reduce pipeline pressures to intermediate distribution pressure. Best practice, where possible, is to have an intermediate pressure line loop the entire distribution system of the town. Other regulators can then be installed at proper points to feed low pressure into the actual distribution lines.

Certain conditions dictate the safest type of regulator installations for feeding an intermediate pressure system. Where there are several regulators feeding into the same line at various points, it is usually best to use regulators which will tend to close in case of a mechanical failure. This is particularly true if the inlet pressure to the regulator is over 100 psi, as it is better to have the regulator close than to place extra high pressure against the inlet of a low temperature regulator.

Two stage reduction into an intermediate system may also be used, as from a safety standpoint it has the advantage of reducing the possibility of freezing as well as giving added protection against mechanical failures. When the inlet pressures are less than 100 psi it is usually best to have the regulators tend to open in case of failure, but only, of course, if the outlet piping is built to withstand this pressure. The usual low pressure distribution regulator will operate satisfactorily with such an inlet pressure and not allow high pressures in distribution..

The power pilot loaded regulator with auxiliary weight and lever or spring loading head results in the accuracy of control obtained by the power pilot loading system along with the dependable safety standby of a direct loaded regulator (*Figs. 6* and *7*). The pilot regulator is set for the desired outlet pressure and the lever and weight or spring loaded head is adjusted so that the diaphragm stem from this head is almost in contact with the diaphragm stem of the pilot loaded regulator. This should be set at low flow rates. Higher flow rates will automatically move the top diaphragm stem further out of contact. In case the pilot regulator should become closed or the pilot loading diaphragm becomes broken, the upper diaphragm case would start into operation at a slightly reduced

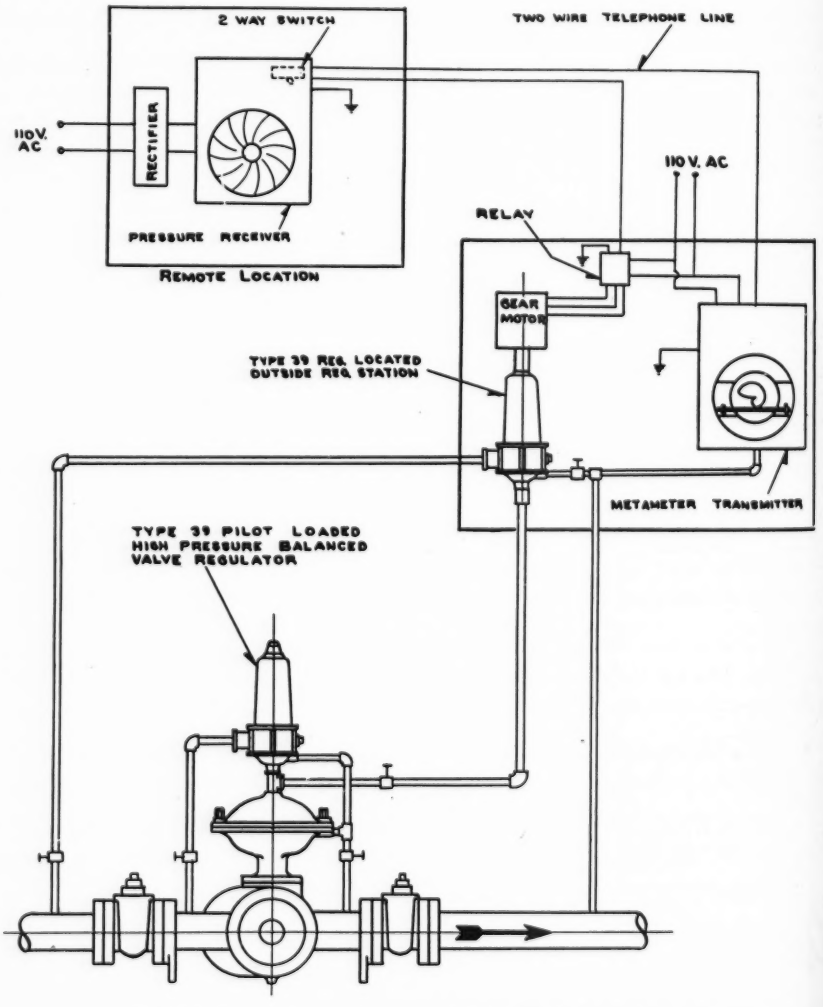


Fig. 12. Remote motor-operated pilot-loaded regulator.

outlet pressure.

Where the nature of the installation makes it necessary to have the valves close in case of emergency, the pilot loading system using a spring underneath the main diaphragm is required. Using such a spring, it is possible to bleed the pilot regulator back to the outlet line and a diaphragm failure results in the valves closing *(Fig. 8)*.

Scrubbers are recommended for removal of rust, welding beads, and other abrasive materials which may be carried through the line. Such materials are objectionable throughout the system, but are particularly detrimental to the valves and seats in regulators used for high pressure cuts. The high pressure balanced valve regulators can be supplied with a spring holding the valves closed. With this arrangement, if abrasive particles should get past the cleaners and completely erode the valve stem, the valves will still be held up against the diaphragm stem and continue to regulate, preventing a large volume of high pressure gas going through the regulator. The regulator would probably vibrate or pulsate after the stem was cut off but will not fall open and proper repairs can be made quickly *(Fig. 9)*.

A dual regulator installation as recommended for pipeline regulators also gives added safety protection at town border stations. With such an installation, the main regulator should tend to close in case of failure, allowing the standby regulator to carry the load. For accurate control, the primary or main regulator should be pilot loaded with a spring to hold the valves in a closed position as shown in *Fig. 8*. The standby regulator is set for a slightly lower outlet pressure. A typical installation is shown in *Fig. 10*. The spring loaded regulator is advantageous in that it will operate in a flooded location as long as the vent line is extended above the highest possible water line.

In cases where the inlet pressure is not excessive, so that it is not detrimental to have the regulator valves open but is important to maintain pressure under any consideration, a spring loaded regulator can be pilot loaded to give accurate control. Failure of the pilot regulator for any reason results in temporary spring control at a lower pressure setting. It is absolutely necessary in this system to use the power pilot loading system which changes loading pressure as required to maintain the outlet pressure. A standard pilot regulator will not result in good regulation. This system must have a small bleed to the atmosphere and should only be used on outlet pressures up to 50 psi. *Fig. 11* shows a typical hook-up.

An excellent method of varying the outlet pressure in step with the load condition in a distribution system is through use of a balanced valve regulator operated by a remotely set power pilot. In this system, the balanced valve regulator is normally loaded with a power pilot regulator set at the minimum required outlet pressure for off-peak loads. Another power pilot regulator having a motor-operated adjustment stem can be mounted outside the regulator house to avoid danger from electric contacts and be connected through supply piping to the same main regulator. By means of a single wire, the motor can be operated to change the setting of the remote power pilot. A Metameter transmitter is used to transmit the outlet pressure back to the central control station.

At the central control station a two-way switch is mounted inside the receiving pressure gauge operated by the Metameter system. When using a 5 to 60-lb pilot spring, the switch can be closed for 15 seconds to change the outlet pressure setting one psi. Reversing the direction of flow of the direct current will operate the relay so as to reverse the direction of the motor drive on the pilot regulator. Stops can be used on the pilot regulator stem to hold the outlet pressure setting between definite maximum and minimum values. This system can be operated up to distance of 15 miles *(Fig. 12)*.

Automatic Water Treatment Feeder

By CHARLES W. MILLER
Midland Gasoline Co., Conroe, Texas

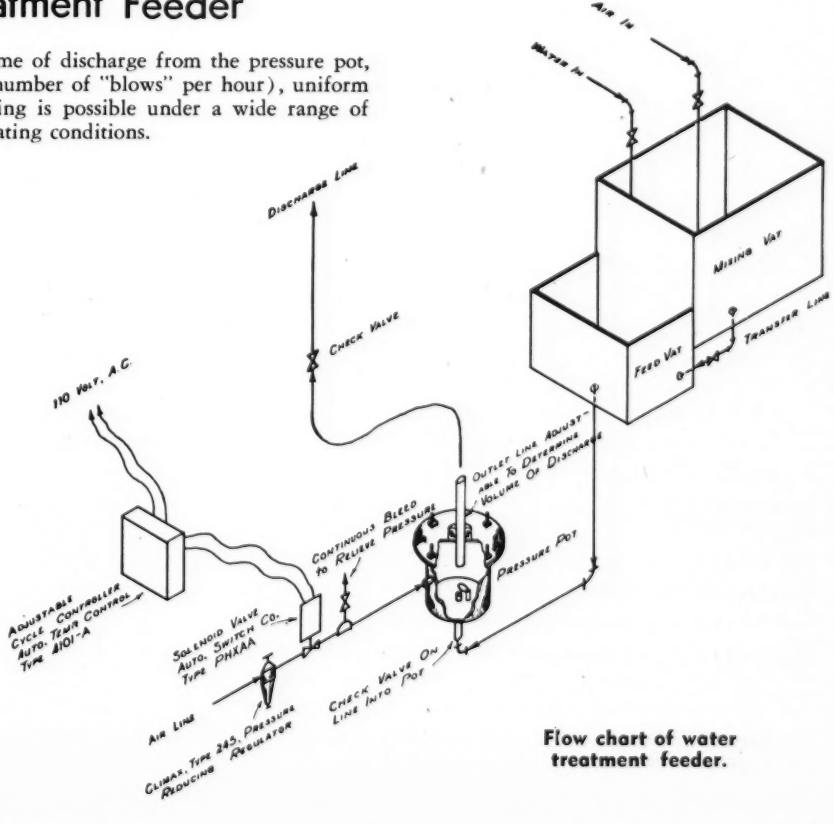
Purpose: To inject controlled amounts of chemical solutions at regular intervals.

The mixing vat is sized for a week's supply of solution and calibrated so solution concentrations are easily controlled. The solution may be mixed and tested while the charge from the feed vat is continuing. Air agitation insures thorough mixing.

Solution flows by gravity from the feed vat through a check valve into the pressure pot. At selected intervals, air pressure forces the solution through the discharge line to the water to be treated. The volume of solution discharged from the pressure pot may be varied by raising or lowering the outlet line through a stuffing box.

The electrical time cycle controller, at predetermined intervals, opens the solenoid valve admitting air pressure to the pressure pot for a selected length of time. The air pressure required is controlled by the pressure reducing regulator. The continuous bleed vents the air pressure and enables the pressure pot to refill.

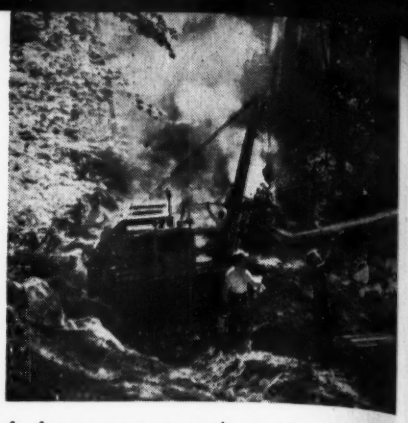
By utilizing the many adjustable features (i.e., by varying the concentration of the solution in the calibrated mixing vat, the volume of discharge from the pressure pot, the number of "blows" per hour), uniform treating is possible under a wide range of operating conditions.



Flow chart of water treatment feeder.

From the Natural Gasoline Assn. of America.

Connecticut is famous for its hills but members of this Bechtel crew undoubtedly would have settled for terrain a little less acclivous.



A dope gang at work on the 16-in. line is too busy to notice spectacular scenery.

Members of a pipe gang don hip boots as they come to a small stream.

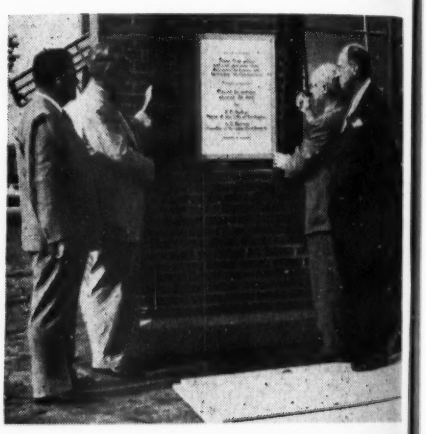
Northeastern Completes Connecticut Line

Torrington, Conn. residents became the first users of natural gas in New England late in August when valves at the city gate were opened, releasing the long-awaited Texas natural gas into the mains of the Connecticut Power Co., which supplies the city.

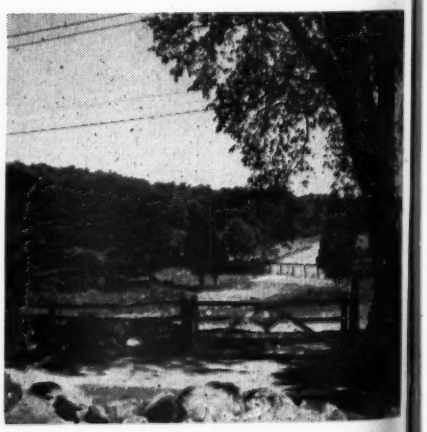
It was 4:25 a.m. when representatives of the utility and Northeastern Gas Transmission Co., which brought the gas to the area, opened the valves and started the flow of the new gas. A few minutes later, valves were turned at the gas plant shutting off the manufactured gas which had been in use for so long and the lines began to fill with the new fuel. Few residents were present as crews worked through the pre-dawn hours lighting equipment at purge points for burning off the old gas. A little later, conversion crews set out to check appliances and instruct residents in operation of them.

Electric men in the predominantly electric utility were forced to take a back seat at dedication ceremonies the next day while members of the gas department put on what was one of the most successful public relations ventures undertaken by the company in recent years. The occasion was hailed as an economic milestone in the history of Connecticut by speakers at the ceremonies and local industrialists of the highly industrialized town were outspoken in their admiration.

Bringing natural gas 2000 miles to Connecticut had not been an easy job by any means, and Northeastern and its contractor, Bechtel, had had to overcome many obstacles to do it. One of the most formidable of these was the rugged terrain of the New England countryside.



A plaque marks the city gate from which natural gas was first delivered.



The casual observer would never suspect that a pipeline lay buried here.

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So many owners are making so much money with Schield Bantam equipment that today this young, fast-growing company *produces more truck-mounted cranes and excavators than any other manufacturer.* In 1951, Schield Bantam also outproduced all other manufacturers of less than ½ cu. yd. excavators COMBINED (including crawler types).

More value per dollar!

Reasons for Bantam leadership are easy to understand. First, Schield Bantam has specialized in developing just *one size* machine, with a complete line of *specially engineered attachments.* By mass-producing this one size unit with modern "assembly-line" methods, Schield Bantam is able to give you *the world's simplest, fastest ⅜ cu. yd. excavator — at the lowest price in the industry!*

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Today, over 3500 truck-mounted Bantams are cutting costs on jobs all over the world. Bantam shovels and draglines load pit run material at 90 cu. yds. per hr. Back Hoes dig 100′ of trench per hr. (5′ depth). Cranes, with 25′ to 50′ booms, speed handling of loads up to 5 tons.

Why *pay more* for a machine that can't *earn more!* Let us prove Bantam's economy on your work today.

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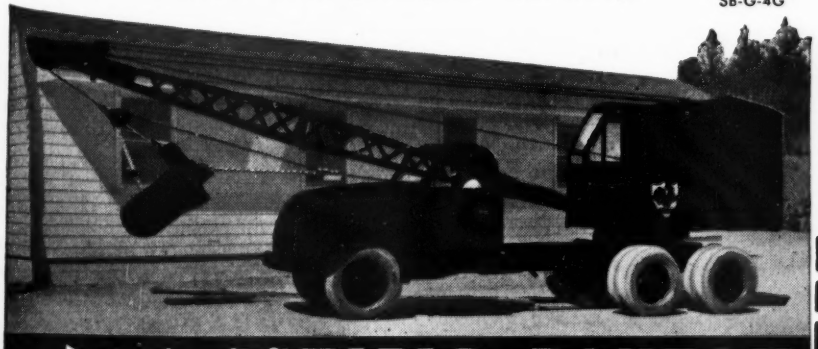

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Far-Reaching Effects Seen In OPS Woodlawn Decision

The famed Woodlawn (Texas) field wellhead price case was decided last month when Ellis Arnall, just before his retirement from office as OPS chief, rejected recommendations for higher price ceilings on gas produced and sold to Mississippi River Fuel Co. by Stanolind Oil & Gas Co., Tulsa, and Continental Oil Co., Houston.

Thus, the OPS-dictated price of 10 cents remains. The plea of the company for 12 cents and the recommendation of the OPS board of review for 11½ cents were overruled.

The decision is expected to be felt at other gas sources. Arnall did not deny that he had Carthage "and other fields" in mind when he turned down the request. Bryan W. Payne Jr., president of Texas Independent Producers & Royalty Owners Assn., predicted that "the petroleum branch may move to prevent escalator clauses in contracts from operating automatically to raise field prices above 10 cents."

OPS said 10 cents is "generally considered tops" for the industry, and there had existed considerable trepidation in the minds of OPSters at the thought of a possible "break-through." Although as of the date the verdict was rendered there was no announcement that the Woodlawn field ceiling will be extended to other fields, the fact that Mr. Arnall "studied" 855 other contracts for gas purchased from other fields in arriving at the 10-cent price indicates that he believes a definite interrelationship of prices exists among fields in the South.

In a lengthy and repetitive 24-page opinion, Mr. Arnall disposed of the protestants' principal contention regarding "prevailing price," propriety of the section of the law invoked, possible violation of another section of the price control law, and certain individual considerations of value.

The 11½-cent recommendation of the board of review, which he turned down in the same application, was based on still another objection raised by the two companies and sustained by the board: that Sec. 23a(b) of CPR 17, Amendment 1 was arbitrary in that it permitted the fixing of a ceiling price by a seller based on written offers to sell without permitting the fixing of ceiling prices based on written offers to buy. Stanolind and Continental both asserted that no producer of natural gas posts price schedules or issues written offers to sell, but instead the normal industry practice is for prospective buyers to make oral or written offers to buy.

Since the highest offer during the base period had been 11½ cents, the companies felt on this basis alone they should be permitted to charge a like amount. When Mr. Arnall first dismissed this portion of the protest last March, no appeal was made. But when the board of review in August issued its report, the other contentions made by the companies were held to be "not determinative of the merits" of the protest, and the board's recommendation upheld them only on the "offer to buy" issue and asked that the section be rephrased in a manner "more in keeping with historical practice in the industry."

The issue was thrown out in the Arnall opinion on the technical grounds that the companies failed to appeal within certain time limits, although the director added that even to accept this issue at such a late date would be, in effect, an altering of his own previous determination, and this he did not choose to do.

As to the first of the companies' charges, that concerning "prevailing price," Mr. Arnall held they were wrong in interpreting "prevailing price" as an individual price rather than as a "general level of existing prices." Furthermore, even if their interpretation were correct, he said, they based their case on the fact that during the "base period" they had received offers of 12 cents, whereas the term "prevailing price" was not intended to refer to figures which were being used as a basis for bargaining but rather "was intended to refer to the price at which products were actually being bought and sold during the designated period."

"It is a term designed to reflect the value of current transactions, not the speculative price of future exchanges," he said.

The differences over which paragraph of which section of the law should cover the companies' case were introduced by the companies in an effort to show that by use of the section invoked by OPS they arrived at a price which was not in line with the price they would arrive at (12 cents) by use of their customary pricing practices. The other section, the director decided, could not be used, however, because it covered only those transactions which "reflect fixed, uniform and stabilized methods of determining prices.'"

"This subsection was not intended, for example, to apply to prices fixed pursuant to the relative bargaining positions of buyers and sellers," he declared. "They have not proved that the well-head prices for the natural gas which they sold at other fields were established according to fixed formula, nor have they shown that the precise factors which they listed were taken into account in ascertaining the prices with which they make comparisons, nor have they shown that there exists a uniform means of ascertaining the respective values which they applied to these factors."

Furthermore, he said, "the data submitted . . . does not conform to the requirement that the requested price be a price in line with the price at other comparable points."

But—even if all the companies' contentions on this issue were true, the law still gives "considerable discretion to the director," he said, so he could still deny the price if he concluded that granting it would not "serve the stated purposes of the Defense Production Act."

Stanolind and Continental also felt they could arrive at the 12-cent price by using a pricing formula based on comparisons with other long-term contracts. But Mr. Arnall held that the companies were not entitled to employ, as standards

(Continued on p. 160)

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(Continued from p. 158)

long-term contracts which related to fields not in the same area (i.e., within 200 miles of Woodlawn); furthermore, that the companies, in setting up comparisons, made specific adjustments on the basis of "value judgments."

"The prices already fixed," he said, "were to be the standard of comparison and not the basis from which a myriad of variations could be made. Prevailing prices were assumed to take account of the variables and as such they were to be the standard."

There were several other factors which the companies charged Mr. Arnall had failed to recognize. They declared he failed to consider the prevailing prices in Woodlawn field during the base period, the value of large vs small reserves, the value to a purchaser of obtaining exclusive control of the companies' supply of natural gas at the one field, the proximity of the field to the market, the general increase in natural gas prices from 1948 to 1951, the fact that natural gas is grossly underpriced as a competitive fuel.

In rebuttal Mr. Arnall cited his study of 855 long-term contracts relating the Southwest gas purchases, many of them entered into as late as 1950 and 1951, none of which exceeded 10 cents on 14.65 psia base and some in fields having much larger reserves than those at Woodlawn. "It was reasonable to conclude that the prices established by the industry itself reflected these several factors," he said.

"The fixing of a ceiling differential of 1.5 cents for each 100 miles distance from the gas field to the consumer market would lead to artificial and perhaps fantastic well-head prices.

"The general increase in prices cited dramatically shows the necessity of keeping a firm ceiling on natural gas prices . . . to 'stabilize the cost of living . . .'"

The price of gas as compared with competitive fuels is a problem completely out of his scope, Mr. Arnall pointed out. "Apparently protestants feel the director is saddled with the obligation of making over the economy, at least to the point where he must adjust real or assumed inequities between industries . . . even though such alleged inequities existed for years and were in no way caused by the current emergency.

"For the director to take on the complicated task of adjusting long standing inequities between industries would make his job impossible."

PIPELINE NEWS

Gulf Interstate Plans $127 Million Pipeline

In an application to the Federal Power Commission, Gulf Interstate Gas Co., a new corporation of Houston, has asked authorization to construct a $127,887,000, 860-mile, 30-in. natural gas pipeline from Point Rayne, La. to Boyd county, Ky. The project would also include 229 miles of various size lateral lines and five compressor stations with a capacity of 8000 hp each. Subject to FPC approval, the company plans to start construction of the project about May 1, 1953 and hopes to complete it by Nov. 1, 1954.

The application stated that Gulf Interstate does not plan to buy gas for resale but will transport 375 MMcf per day for United Fuel Gas Co., Charleston, a Columbia Gas System subsidiary. This would be delivered to United in Boyd county, Ky. and to Central Kentucky Natural Gas Co., an affiliate of United's, at a point in Montgomery county, Ky. The proposal says the capacity of the line could be increased to 565 MMcf by the construction of additional compressor facilities, if needed.

Gulf Interstate said that United has contracted for substantial quantities of gas in Cameron parish, La. and is now completing negotiations for gas reserves in Vermilion parish, La. which will bring the total it would have under contract to over 2 million MMcf.

El Paso Plans Increased Delivery from Two Fields

In two new applications to FPC, El Paso Natural Gas Co. is asking approval to construct pipeline facilities in Texas, New Mexico, and Arizona which will increase the daily delivery capacity of its system by 400 MMcf of natural gas per day in these states and California. The construction planned includes approximately 822 miles of main transmission loop line and 44,900-hp main line compressor capacity.

The company is already at work on a major project which will double the amount of San Juan basin natural gas delivered to three California companies—Southern California Gas Co. and Southern Counties Gas Co., Los Angeles, and Pacific Gas & Electric Co., San Francisco—as authorized last June. This construction includes two new compressor stations in New Mexico on the company's 450-mile transmission line to California, and many miles of gathering lines which will carry the gas to its huge processing plant near Fruitland, N. M.

One of the new applications proposes construction of 725.7 miles of main transmission loop line and 37,400-hp main line compressor capacity which will enable El Paso Natural to deliver 300 MMcf per day from the Permian basin. Of this gas, 200 MMcf would be for delivery to the three California companies mentioned above. The remaining 100 MMcf would go to present customers in Arizona, New Mexico, and Texas. This project will also include about 181 miles of field transmission lines; 124,100-hp in field compressor stations; and purification, dehydration and amine recovery plant additions. The total cost of this project is estimated at $140,250,000.

The other application asks approval of 96.6 miles of main transmission loop line; 7500-hp in main line and 5500-hp in field compressor stations; dehydration and gasoline absorption plant additions; and field gathering lines. This construction, estimated to cost $36 million, will provide for delivery of an additional 100 MMcf of gas per day from the San Juan basin to the three California customers.

FPC Has Difficulties, Says Chairman Buchanan

The Federal Power Commission is having "extreme difficulty" coping with the number of applications for increases in wholesale natural gas rates, according to a recent release. Final action usually cannot be taken on a proposed increase within five months.

The law allows increases to be effected after that period if action has not been taken, increases being collected under bond subject to refund of any amounts later disallowed by the commission.

Commission Chairman Thomas C. Buchanan gave these facts and figures to show how bad he thinks the situation is:

At the end of fiscal 1952, last June 30, more than $45 million a year in increased rates were being collected by companies under bond. Some companies have filed for second, even third, increases before the first has been disposed of. Increases of $159,512,000 applied for in fiscal 1952 were 200 times greater than the $645,000 requested in 1949.

Mr. Buchanan reported that of the $140,312,000 requested increases acted upon for 1952, the commission suspended $139,032,000 and accepted the remaining $1,280,000. He said the commission disallowed $22,117,000 of the suspended filings and allowed $15,295,000 to be effective; $7,103,000 were withdrawn by companies.

The "unprecedented flood" of new applications continue, Mr. Buchanan pointed out, with increases totaling more than $54,140,000 being requested since June.

Mississippi Valley To Buy Out Mississippi Gas

Mississippi Valley Gas Co., Jackson, has been authorized by FPC order to acquire and operate natural gas transmission facilities of Mississippi Gas Co., Meridian, a subsidiary of Southern Natural Gas Co., Birmingham, Ala.

For $3,321,000, Mississippi Valley will acquire all physical facilities, franchises, accounts receivable, contracts and leases of Mississippi Gas, after which the latter company will no longer exist. Mississippi Valley will also acquire numerous distribution systems either owned or operated under lease by Mississippi Gas.

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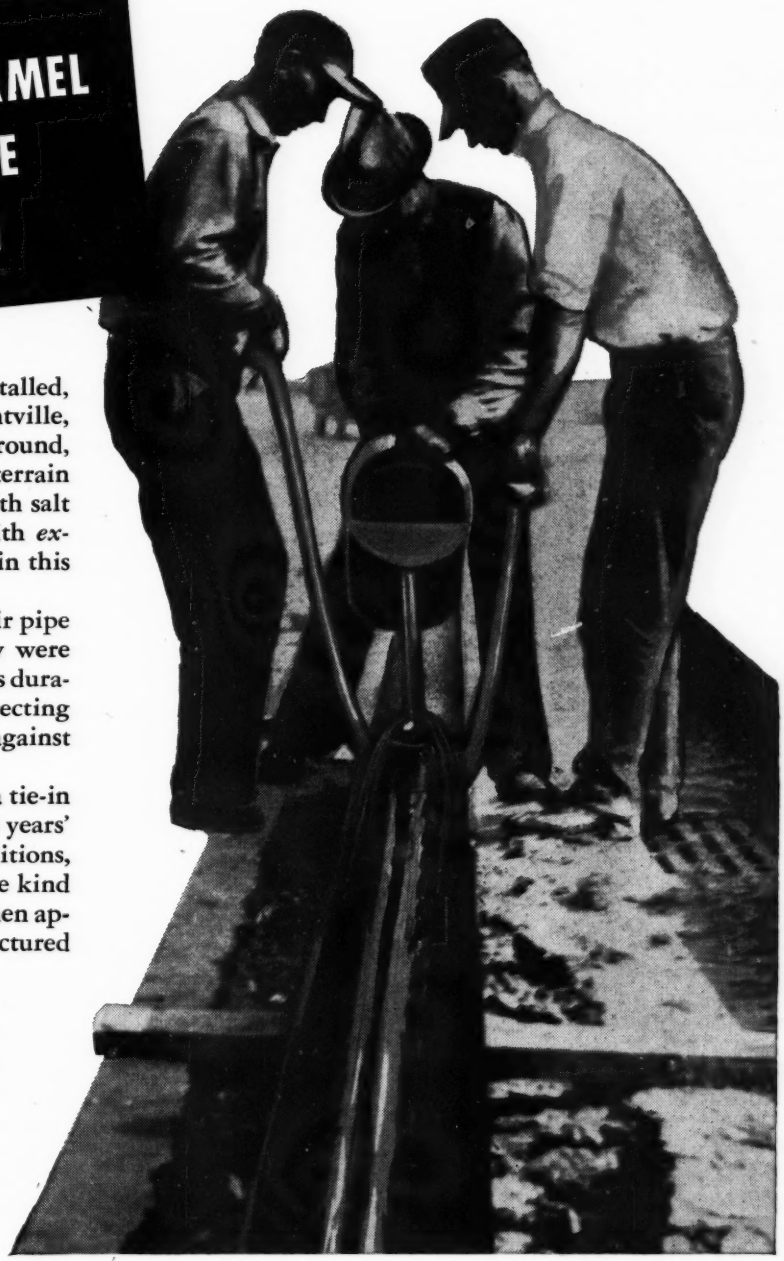

IN 1926, a 6-mile, 8-inch gas pipe line was installed, extending from Atlantic City to Pleasantville, N. J. This line was laid about two feet underground, in land known locally as "the meadows." The terrain is tidal marsh and high tides flood the land with salt water. No steel pipe line, unless provided with *exceptional* protection, could possibly last long in this corrosive soil.

The owners knew this and therefore had their pipe line protected with Bitumastic Enamel. They were influenced, to a great extent, by the fact that this durable enamel had already proved its value by protecting ships and large-diameter steel water lines against corrosion.

In 1951, a pipe section was removed so that a tie-in could be made with another pipe line. After 25 years' exposure to tidal marsh and sea-water conditions, there wasn't a sign of corrosion. This shows the kind of protection Bitumastic Enamel gives, even when applied by the old-fashioned manual method pictured here.

Today, of course, gas and oil pipe lines are cleaned, primed, coated and wrapped mechanically. Further—improvements have been made in Bitumastic Enamels in the last 25 years. Give your next pipe-line project *lasting* protection against corrosion by specifying Bitumastic Enamels. Your Koppers representative will give you complete details and estimates.

Photograph made in 1926 shows gas pipe line (Atlantic City—Pleasantville) being coated with Bitumastic Enamel. A single coat of enamel was applied by the "Sling Method" to a minimum 1/16" thickness. In 1951, a pipe section was removed so that a tie-in with another line could be made. An examination revealed no sign of corrosion.

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The facilities involved include about 71.5 miles of line, a 600-hp compressor station, and appurtenant facilities in Clay, Monroe, Chickasaw, and Lee counties, and facilities to be acquired by assignment of lease which include 99 miles of pipeline in Winston, Choctaw, Webster, Calhoun, Oktibbeha, and Chickasaw counties. Mississippi Gas has operated these under lease from North Central Natural Gas District.

Southern Natural Expansion Authorized

At long last the FPC has partially approved three applications, one of which was originally filed in April 1951 by Southern Natural Gas Co., Birmingham, Ala. for facilities to increase capacity of its system. A total of 152.5 miles of line and four compressor stations totaling 22,750 hp were granted temporary authorization. These facilities will bring the daily capacity of the system to 670 MMcf. Additional facilities to increase the capacity to 1020 MMcf are still pending approval.

Sixty miles of line and three compressor stations were approved. The compressor stations, totaling 19,450 hp, will be located in Jefferson Davis and Clark counties, Miss. and Hale county, Ala. The approved lines include a 20-mile supply line in Ouachita parish, La.; 33 miles of triple loop in Ouachita and West Carroll parishes, La.; and 7 miles of triple loop in Sharkey county, Miss. These facilities, estimated to cost $9,265,000, will increase the capacity of the system by 115 MMcf per day, and will enable the company to meet increasing requirements of its present markets and supply five new markets in Alabama and three in Georgia.

Ruling on another application granted temporary authorization for Southern Natural to construct 87.8 miles of 24-in. loop line and 4.7 miles of 14-in. loop line at an estimated cost of $5,268,600. Approval of the overall application, which includes an additional 1102.2 miles of pipelines and four compressor stations totaling 13,850 hp at an estimated cost of $76,000,000, was withheld pending further hearings.

On a third application, the commission granted temporary authorization and construction is under way on a 3300 hp compressor station in the Logansport field in Louisiana, needed because of declining wellhead pressures. Estimated cost of this project is $1,021,500.

2500-Mile European Line Found Practical

A 2500-mile natural gas pipeline which could benefit 17 Middle East and European countries has been found practicable by American engineers, according to Sen. A. Willis Robertson.

The artery could be laid, the engineers report, from the Middle East oil fields beginning at Kirkuk, Iraq, where 1000 MMcf of natural gas is being lost daily, through Turkey and northern Greece to Yugoslavia and Trieste. Cutting across north Italy, the line would go through the Brenner pass to Austria, southern Germany and then to Paris. It would require 15 pumping stations and could be completed in three years, it was estimated. Branch lines could serve most of the consuming centers of Europe.

Senator Robertson said such a project might cost from $425 to $475 million, with additional investments required in cities where local distribution systems were built. The delivered cost of gas would be about 32 cents for 1 Mcf, making it available to European industries at less than half the present cost of coal or oil.

Proposed route of Pacific Northwest's line.

1400-Mile Pipeline Application Filed

Pacific Northwest Pipeline Corp., Houston, has filed an amended proposal with FPC for a 1400-mile pipeline from San Juan basin through which it hopes to serve the Pacific Northwest.

The original application, filed in June 1950, which proposed to transport gas from Texas via a 2175-mile line, was amended early in 1952 with a proposal to import gas from Alberta. When Westcoast Transmission Co. was awarded the right to import the Alberta gas, Pacific Northwest revamped its plans and began assembling blocks of acreage in the San Juan basin (see August *GAS*, p. 120).

The proposed line, which would carry approximately 314 MMcf of gas daily, would extend about 1384 miles from the San Juan basin at a point near Ignacio, Colo. to the Seattle area. Eight compressor stations, totaling 61,000 hp, and 316 miles of spur and lateral lines would be installed on the system. Development of the San Juan basin will eventually include 600 wells, according to the company's plans. Overall cost of the project is estimated at $179,000,000.

29-Mile Pipeline Planned

Seeking FPC authorization, Fredericksburg (Va.) Natural Gas Co. has filed an application to construct 29 miles of pipeline to transport natural gas to Fredericksburg and nearby area.

The proposed line, which would connect with the system of Transcontinental Gas Pipeline Corp., Houston, at a point in Culpepper county, Va. and extend to Fredericksburg, would include 28½ miles of 4¼-in. pipe and about .72 mile of 3½-in. pipe. The estimated cost of the project, $746,690, includes $316,730 for acquisition and alteration of a municipally owned manufactured gas distribution system in Fredericksburg. Initial capacity of the line would be about 1718 Mcf, which would be increased to 2877 Mcf by the beginning of the third year of operation.

Algonquin Again Delayed By Irate Residents

While New England waits for the natural gas service which the Algonquin Gas Transmission Co. had planned to deliver to some communities by October, the transmission company continued to be blocked by irate citizens.

One of the main disturbances last month came in the form of cars parked in the direct path of the pipeline near Cortlandt, N. Y. One, belonging to Chester Rick, a retired consulting engineer, remained in the path of construction for at least a week and the company reported the delay was costing approximately $500 an hour.

During last month 81 property owners, including Mr. Rick, petitioned the New York Public Service Commission to halt construction until rigid safety regulations were established. They charged that minimum safety and cheapest pipe were being used.

Meanwhile the company decided to proceed across 18 parcels of land near Bridgeport, Conn., for which it had reached no agreement for right of way, even though a Connecticut supreme court decision may make it a trespasser. The Massachusetts executive council approved construction of lines under Taunton and Palmer rivers providing the requirement that the company will remove the lines if state public utilities department so orders.

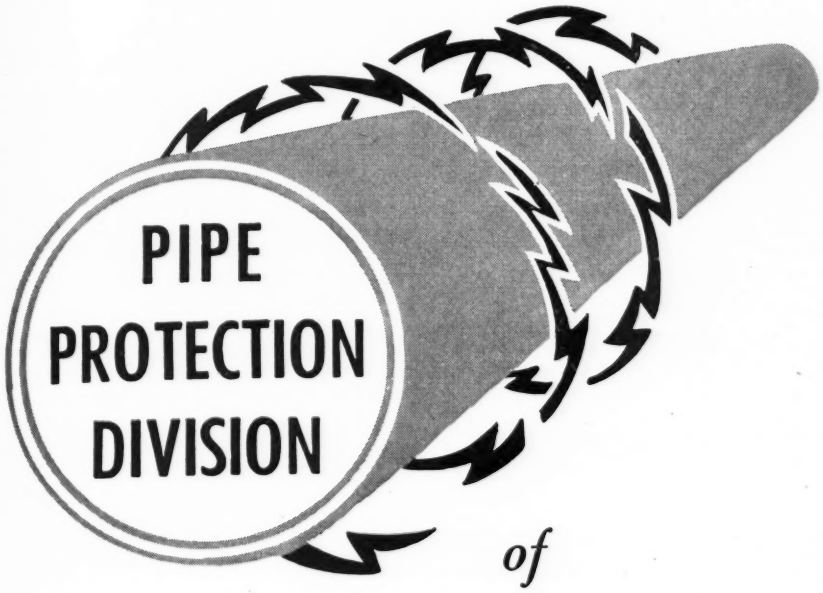
In Danbury, Conn., the state public utilities commission approved construction under town highways but town officials took immediate steps to appeal the ruling. Two employees of the construction company, Tulsa-Williams Co., were arrested for alleged violation of state statutes pertaining to use and discharge of explosives.

Morris County (N. J.) Board of Freeholders decided its road department will repair damage caused to county roads by the pipeline company but Algonquin will be charged for such repairs. They accused the company of "irresponsibility" and said it had been "reckless" and caused much unnecessary damage.

Public Service Asks Line OK

FPC has been requested to authorize construction of 16.3 miles of pipeline by Public Service Electric & Gas Co., Newark, N. J. The lines would transport natural gas received from the Texas Eastern Transmission Corp. near Linden, N. J., would cost about $4.2 million.

Included in the project are 11.3 miles of 16-in. pipeline to extend from Texas Eastern's line to Harrison. At Harrison two short branch lines, 2.04 miles of 12-in. and 2.96 miles of 10-in., would extend to Public Service's Harrison Gas Works and its West End Gas Works at Jersey City. The gas received at these plants would be used in production of mixed gas to be distributed to the company's New Jersey market.



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E-24

Six Months' Authorizations Total $235 Million

Natural gas pipeline facilities which will add more than 1250 MMcf daily delivery capacity to the nation's transmission systems were authorized by the Federal Power Commission during the first six months of 1952, Chairman Thomas C. Buchanan has reported. These facilities include 1915 miles of pipelines and have an estimated total construction cost of $235.4 million.

The major projects approved—those over $700,000 (see Table)—account for over $179.7 million of the total construction cost and will benefit 101 cities of 50,000 population or over in 25 states and the District of Columbia, as well as numerous small communities. The largest single authorization was for Tennessee Gas Transmission Co.

Mr. Buchanan reported further that during the 12-month period which ended June 30, 1952, the commission has authorized 3378 miles of pipeline and 539,510-hp compressor capacity at an estimated cost of $321.9 million. The major projects accounted for $255.6 million of the construction costs for 2449 miles of line and 430,990-hp compressor capacity to increase daily capacity of the pipelines by 1500 MMcf. He also compared these figures to the total projects authorized by the commission since Feb. 7, 1942, when the present regulations went into effect. The total pipeline milage is nearly 45,800 with 3,300,000 hp in compressor installations at an approximate cost of $3.2 billion. These facilities represent an aggregate of 17,000 MMcf per day in line capacities.

Chairman Buchanan noted, however, that the amount of gas actually delivered will be somewhat lower as the same gas will be transported through the new facilities of two or more different companies in some cases. As an example he cited the project of El Paso Natural Gas Co. Authorized to increase the capacity of its line by 320 MMcf, El Paso will deliver that amount to Pacific Gas & Electric, Southern California Gas and Southern Counties Gas which will further transport the gas by facilities authorized during the same period.

FPC Rules on Columbia System Applications

The Federal Power Commission ruled recently on applications for construction of facilities by six Columbia Gas System subsidiaries—three of the Charleston, W. Va. group and three in the Pittsburgh group.

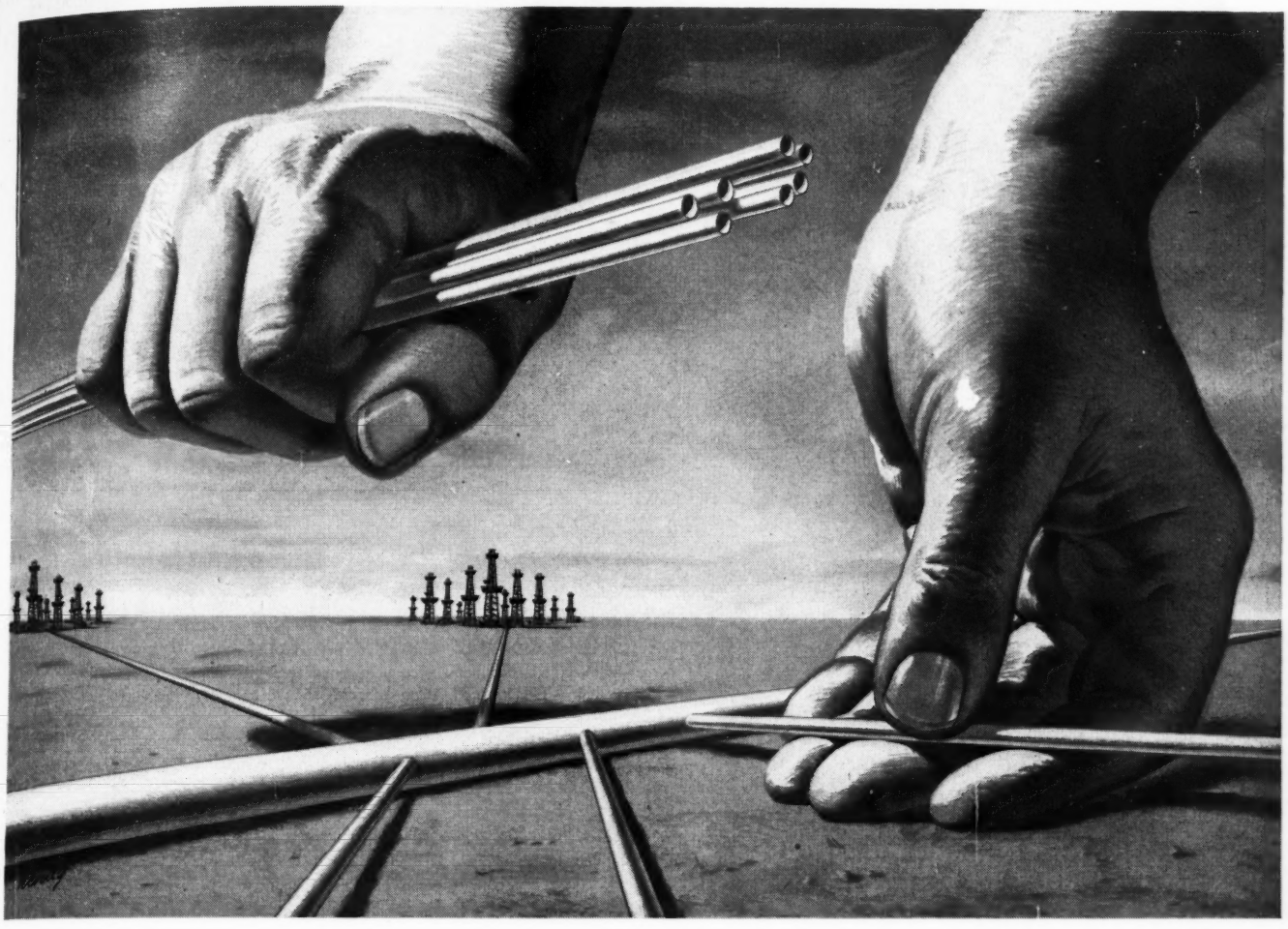
For the Charleston group, applications of Atlantic Seaboard Corp. and United Fuel Gas Co. for additional facilities were granted temporary authorization but the commission denied Central Kentucky Natural Gas Co.'s request to build about 9 miles of line in Kentucky to increase its capacity in the Cincinnati area.

The Manufacturers Light & Heat Co., Natural Gas Co. of West Virginia, and Home Gas Co., all of Pittsburgh, were authorized to construct facilities in Ohio, Pennsylvania, and New York.

Atlantic Seaboard Corp. was authorized to construct two new compressor stations on its 26-in. main transmission line between

Federal Power Commission Certificates of Public Convenience and Necessity granted between Jan. 1, 1952 and July 1, 1952. (Authorizing construction of $700,000 or more.)

Applicant	Description and Purpose	Estimated Cost
Cumberland & Alleghany Gas Co. and Manufacturers Light & Heat Co.	51 miles of 4-in. to 10-in. lines and 2080-hp station in Mountain Lake Park field, Md. to tap field.	$ 2,197,637
Colorado Interstate Gas Co.	48 miles of 20-in. loop on Denver line, 22 miles of 6⅝-in. laterals in Denver area, 7080-hp additions in stations in Texas and Colorado, to boost capacity by 84 MMcf to Denver and Pueblo, Colo.	3,379,532
New York State Natural Gas Corp.	66 miles of 20-in. loop in Pennsylvania, 17 miles of 16-in. loop in N. Y., 22 miles of 14-in. replacements, 1820-hp additions in units to boost capacity by 100 MMcf to cities in N. Y., Ohio and Pa.	6,018,900
United Gas Pipe Line Co.	11 miles of 20-in. line to connect Turtle Bayou and Kent Bayou gas fields in Louisiana to system.	1,461,000
The Ohio Fuel Gas Co.	31 miles of 20-in. from Treat station in Weaver storage in Ohio to augment capacity to Columbus, Springfield, Dayton, Toledo, Hamilton and Cincinnati in Ohio.	1,440,000
Washington Gas Light Co.	For storage 21 miles of 24-in., 4800-hp station near Rockville, Md. for standby storage for Washington, D. C. area.	6,820,000
Lone Star Gas Co.	70 miles of 20-in. from Garvin county, Okla. to Petrolia (Texas) station to connect new source to serve Wichita Falls, Texas, district.	2,799,400
Cities Service Gas Co.	15 miles of 20-in. replacement connection with Grabham station, Kansas, and additions to two stations of 1360-hp to increase service on peak days on southern trunk in Kansas and Missouri.	811,800
Cities Service Gas Co.	21 miles of 26-in. to replace smaller lines in Franklin county, Kan., 1000-hp addition to Welda station for service in Kansas City, Kan. and Kansas City, Mo. area.	1,378,500
Amere Gas Utilities Co.	32 miles of 8⅝-in. and 2 miles of 3½-in. lines to increase capacity by 5 MMcf to West Virginia.	802,340
Chicago District Pipeline Co.	12 miles of 30-in. line connecting with Texas-Illinois Natural Gas Pipeline Co. near Elgin, Ill. to Public Service Co. of Northern Illinois.	1,650,000
Tennessee Gas Transmission Co.	591 miles of 24-in., 26-in., and 30-in. loops along existing system, 304 miles of 24-in. transmission line from Mercer, Pa. to Utica, N. Y.; 137,000-hp additions to stations, 28,000-hp in new stations; 250 miles of laterals to increase capacity by 205 MMcf for service to New York state, New England, Tennessee, and Kentucky.	128,216,000
El Paso Natural Gas Co.	37 miles of 24-in. loops in Arizona, 34 miles of field lines in New Mexico, 46,640-hp in new additions to existing stations in New Mexico and Arizona to increase system by 120 MMcf from San Juan basin, New Mexico, to California.	26,050,000
El Paso Natural Gas Co.	143 miles of 28-in. and 30-in. loops, 295 miles of 6-in. to 30-in. field lines in Texas, 153,960-hp additions to existing and new stations in Texas, New Mexico, and Arizona to increase system by 200 MMcf for California.	62,695,000
Pacific Gas & Electric Co.	86 miles of 34-in. loops on Texas line, 19,540-hp additions in stations to increace capacity by 150 MMcf.	13,428,000
Nevada Natural Gas Pipe Line Co.	114 miles of 12¾-in. line from connection with El Paso Natural Gas Co. near Topock, Ariz. to Las Vegas, Nev. to receive initially 20 MMcf from El Paso Natural.	2,319,140
Southern California Gas Co. and Southern Counties Gas Co. of Calif.	20 miles of 30-in. loops in California, additions to stations of 13,520-hp to increase capacity by 150 MMcf.	5,053,686
Northern Natural Gas Co.	213 miles of 26-in. loop in Kansas, Nebraska, Minnesota; stations aggregating 100,160-hp in Texas, Kansas, Nebraska, Iowa to increase service by 225 MMcf to towns in Iowa, Minnesota and Nebraska.	38,690,000



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Electric Resistance and Fusion Weld—Plain End	8⅝" to 20" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅝" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
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Cobb, W. Va. and Rockville, Md. The stations will have a capacity of 5000 hp and 2640 hp.

United will build a total of 21.5 miles of pipeline and 4840 hp in compressor capacity by adding 3960 hp to an existing station and building a new 880-hp station. It also plans to acquire and activate two additional pools in Wood and Upshur counties, W. Va. The project authorized will allow expansion of the underground storage operation and protect existing transmission facilities.

Temporary authorization was granted the Manufacturers Light & Heat Co. to construct 9.3 miles of line, and to retire about 15 miles of line in Allegheny, Washington, Beaver, and Clarion counties, Pa., a compressor station in Lawrence county, Pa. and a compressor unit in Columbiana county, Ohio. The authorization did not cover the construction of another 30.6 miles of line and the retirement of 19.8 miles of line proposed in the application.

The Natural Gas Co. of West Virginia was authorized to build 21 miles of pipeline in Columbiana and Stark counties, Ohio, and retire two compressor units in Belmont county, Ohio, while Home Gas Co.'s application was approved for approximately 13 miles of line in Chemung and Broome counties, N. Y. on its existing system. Total cost for construction planned for the Pittsburgh group is estimated at $3,829,677.

FPC Takes Action On Several Rate Cases

Applications for increases in wholesale natural gas rates continued to pile up before the Federal Power Commission. Among those recently acted on by the commission, the largest was a petition from Tennessee Gas Transmission Co., Houston, for increases of approximately $17,850,000. The application was one of seven totaling approximately $33,077,000 per year, which the commission suspended.

The other six suspended applications were for Hope Natural Gas Co., Clarksburg, W. Va., $2,334,000; Commonwealth Natural Gas Corp., Richmond, Va., $516,000; and four Columbia Gas System subsidiaries, all with offices in Charleston, W. Va.—United Fuel Gas Co., $6,974,000; Central Kentucky Natural Gas Co., $1,085,000; and Atlantic Seaboard Corp. and Virginia Gas Transmission Corp., $4,318,000.

Approximately 85% of Tennessee's proposed increase was claimed to be necessary because of increases in the cost of purchase gas, largely because of higher prices to become effective Feb. 1, 1953. Petitions for all or most of the amounts requested by the other six companies resulted from Tennessee's proposed higher rates.

Texas Eastern Transmission Corp., Shreveport, has applied to the FPC for an increase of approximately 37%, or $1,800,000 yearly and claims it is only getting a 2.59% return on its investment, which will drop to 1.5% when it pays more for its gas this fall. The FPC denied the $3.1 million increase proposed by Mississippi River Fuel Corp. and ordered the St. Louis firm to refund to its gas utility customers all excess charges since Sept. 1.

An FPC order to reduce gas service rates by $3,111,187 annually has been received by

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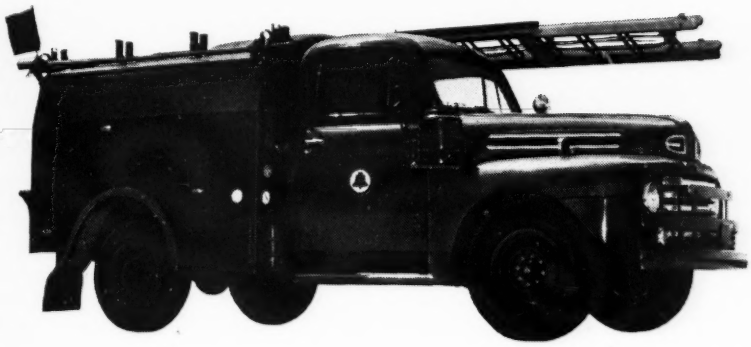

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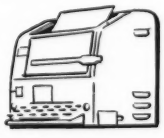

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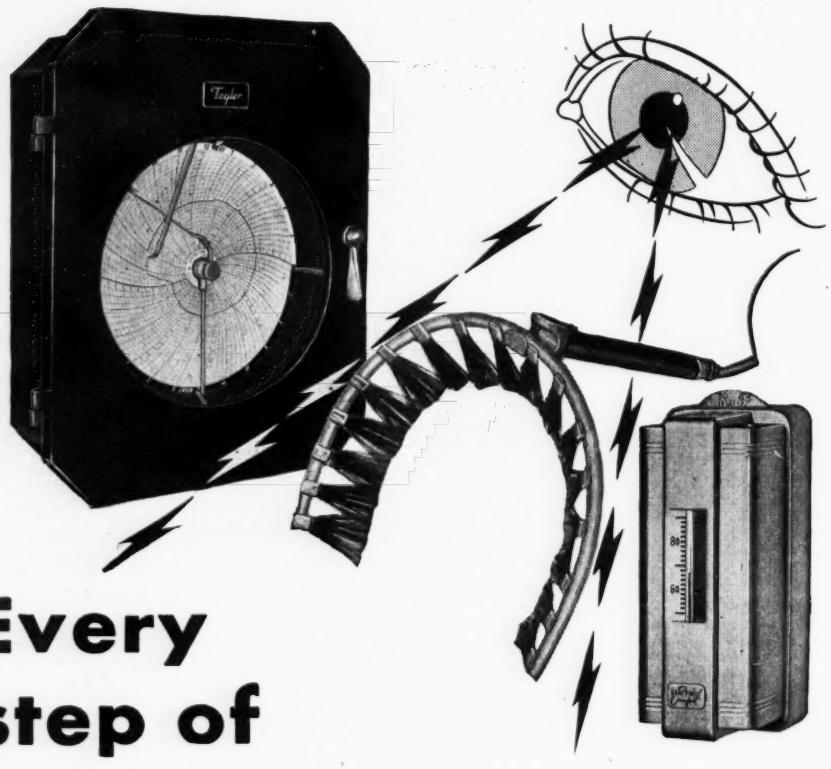

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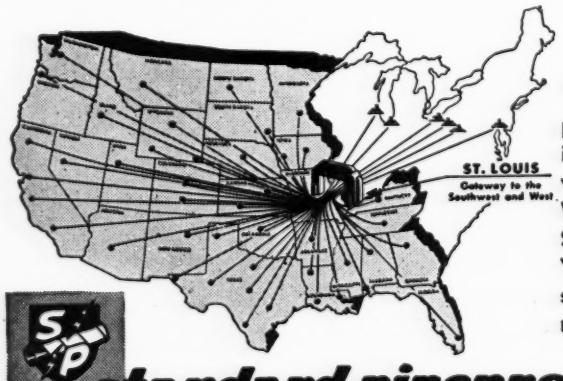

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the Colorado Interstate Gas Co. The order, termed "unjust" by Robert W. Hendee, president of the Colorado Springs firm, would lower the rates of Public Service Co. of Colorado, Colorado-Wyoming Gas Co., Pueblo Gas & Fuel Co., Pikes Peak Natural Gas Co., Florence Natural Gas Co., and the cities of Colorado Springs and Trinidad.

Additional rate actions include FPC's denial of Northern Natural Gas Co.'s motion for stay of order disallowing $7,601,853 of a $10,000,000 increase; suspension of the Cincinnati (Ohio) Gas & Electric Co.'s proposed increase of $89,000; applications for increased rates for Alabama-Tennessee Natural Gas Co., Florence, Ala., $313,000 and Roanoke (Va.) Pipe Line Co., $89,000; application by El Paso Natural Gas Co. to add 4.41 cents per Mcf to the price of gas delivered to Southern California Gas Co. and Southern Counties Gas Co. This would add $6.5 million annually to the sum now paid by the Los Angeles utilities.

Lone Star Begins 70-Mile Oklahoma-Texas Pipeline

Lone Star Gas Co. has begun construction of a 70-mile major gas transmission line of 20-in. diameter from Garvin county, Oklahoma to Petrolia in Clay county, Texas where it will feed Lone Star's interconnected pipeline system, announced Julian L. Foster of Dallas, general superintendent of the transmission division.

The 70-mile main line, plus dehydration stations and field gathering lines will cost in excess of $4.5 million, Mr. Foster said and will have an initial daily delivery capacity of 85 MMcf. The new line will serve many outlying towns and will also increase the availability of gas for the Dallas and Fort Worth distribution areas by about 30 MMcf under maximum delivery facilities.

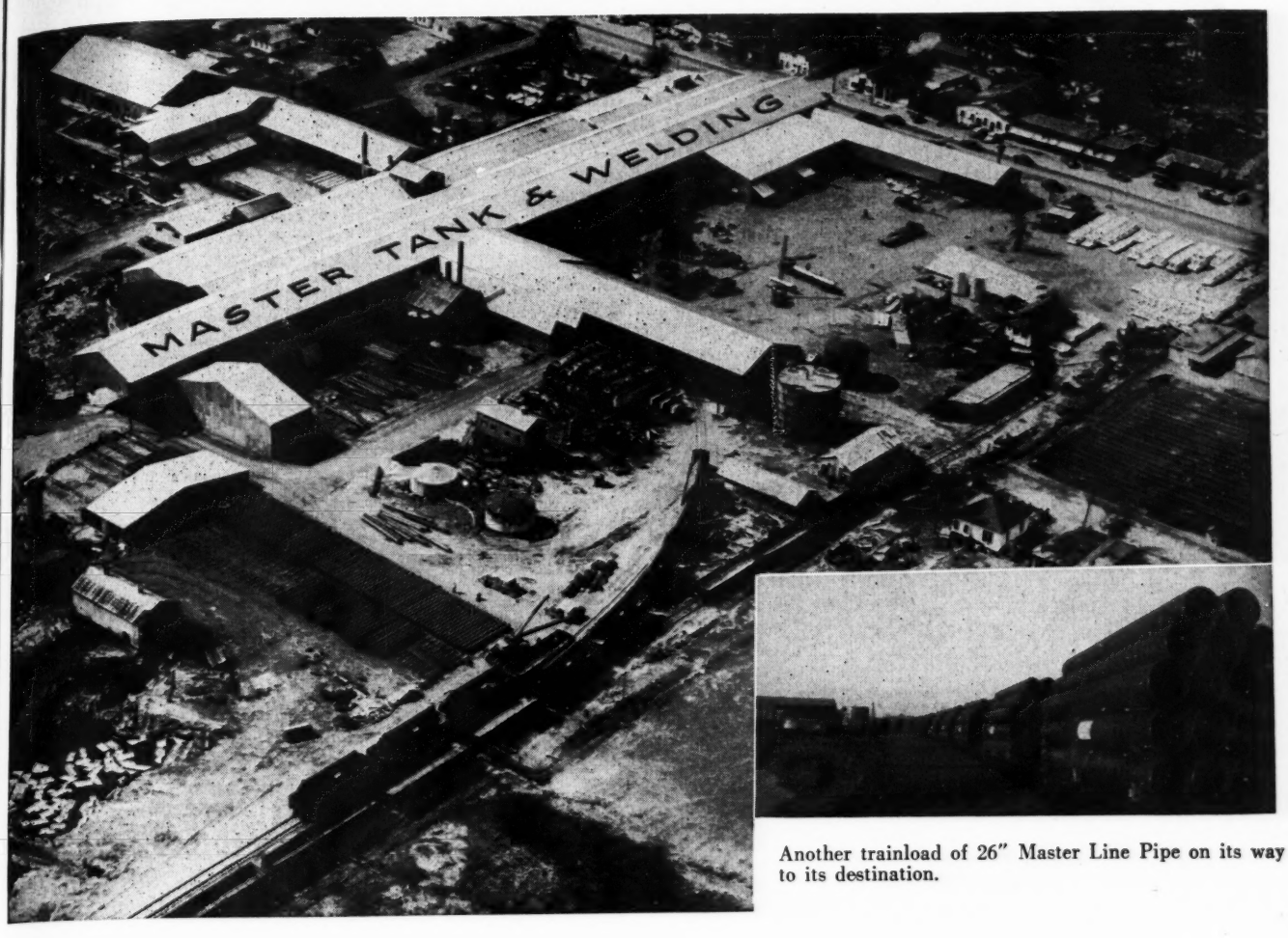
Construction was to have started in July with the line in service by October, but work was postponed when pipe was not available owing to shortages resulting from the steel strike. New timetable calls for the line to be in service by early December.

The Garvin county-Petrolia line will take gas from numerous wells in the vast Golden Trend area in Oklahoma and from the Doyle and Velma-Cruce fields in Stephens county, Oklahoma. These and other supplies will require more than 50 miles of gathering lines ranging from 2 to 20 in. Dehydration plants are to be built at three locations.

Service Changes Approved In New England

In a recent order FPC authorized the Northeastern Gas Transmission Co., Springfield, Mass. to make certain changes in its service to New England, and authorized the Connecticut Gas Co., Berlin, to construct two of five short lines planned. The remainder of the application was held open.

Northeastern was authorized to sell up to 7 MMcf of gas per day to the Haverhill (Mass.) Gas Light Co., rather than 5.4 MMcf per day to that company and 1.6 MMcf to Haverhill Electric Co. with which it has merged. The order also permits sale of 4.1 MMcf of gas per day to Central Massachusetts Gas Co., Worchester, which has ac-



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quired the facilities of the Worchester County Electric Co. and the Spencer (Mass.) Gas Co. The Wachusett Gas Co., which has acquired the distribution facilities of Leominster (Mass.) Gas Light Co. and the Wachusett Electric Co., will receive 4.1 MMcf per day.

Under terms of the order the Connecticut Gas Co. will receive the supply of gas previously authorized for delivery to Connecticut Light & Power Co., Hartford. The newly formed subsidiary of Connecticut Light will transport the gas, for sale to its parent company, through two lines totaling about 2.7 miles, extending from connections with Northeastern's system to gas plants of Connecticut Light & Power at Winstead and Norwalk.

Gathering Line Under Way

The Lone Star Gas Co., Dallas, was scheduled to begin construction last month of an 11-mile gathering line of 8- and 10-in. pipe with an initial capacity of 30 MMcf per day. Also included in the project, estimated to cost more than $234,000, will be two dehydration plants.

The line will connect with the company's transmission system four miles east of Whitesboro and extend north 2.9 miles where it will form a Y, one branch bringing gas from the Big Mineral fields in Grayson county where a dehydration plant will be located, and the other picking up residue gas from the Texas Natural Gasoline Corp. plant in the Sandusky field where the other dehydration plant will be built. The company said the capacity of the line can be raised to 50 MMcf if the development of the field warrants.

Michigan-Wisconsin Plans Pipeline to Serve Midwest

Michigan-Wisconsin Pipeline Co., Detroit, has announced it plans to build a multimillion dollar pipeline from the Gulf coast area to the midwest which would about double present natural gas supplies available to the company's customers in Michigan, Wisconsin, Iowa, and Missouri.

Completion of the plans, however, depend on FPC approval of the company's request for higher rates. Michigan-Wisconsin has asked the commission to approve a $3.1 million annual increase which was put into effect under bond Oct. 1, 1951. It also seeks approval of an additional $3.8 million annual increase which would boost the Mcf rate to 35 cents.

American Natural Gas Co., parent firm of Michigan-Wisconsin, has been negotiating with owners of substantial gas reserves in the Gulf coast area for gas which will supply the proposed system if negotiations are successful.

Tube Turns Buys Kerotest

Arrangements were completed last month for the acquisition of all the common stock of Kerotest Manufacturing Co., Pittsburgh, by Tube Turns Inc. of Louisville, Ky. The new management will take over operation of the Kerotest plant, which will operate under its own name and retain present officers and personnel, immediately.

New officers will be George O. Boomer, chairman of the board; John G. Seiler, vice president; Robert J. Landolt, vice president, all of Tube Turns. Present officers, Walter G. Swaney, vice president and secretary, and J. D. Isaacks, vice president, will remain in the same capacity. The presidency of Kerotest will be filled at a later date.

Pipe Priorities Allocated

Although deliveries are still dependent upon continuing effects of the steel strike, PAD last month alloted priorities for steel pipe for the final quarter of 1952 to several large pipeline projects and numerous smaller projects. The Wilcox Trend gathering system, Dallas, was allocated 20,952 tons of pipe; El Paso Natural Gas Co., 20,505 tons to provide additional gas to California; Tennessee Gas Transmission Co., Houston, 42,854 tons to expand its New England system; and Pacific Gas & Electric Co., 17,000 tons for looping a section of its present system to add 100 MMcf capacity. Approximately 167,567 tons of pipe were also allocated to more than 400 smaller projects.

New Gas Field Located

Richfield Oil Corp. has discovered what it believes may be a new gas field in the Marysville area of the Sacramento valley, Calif. In a drill stem test of about 90 ft in a well located 1½ miles west of Sutter City

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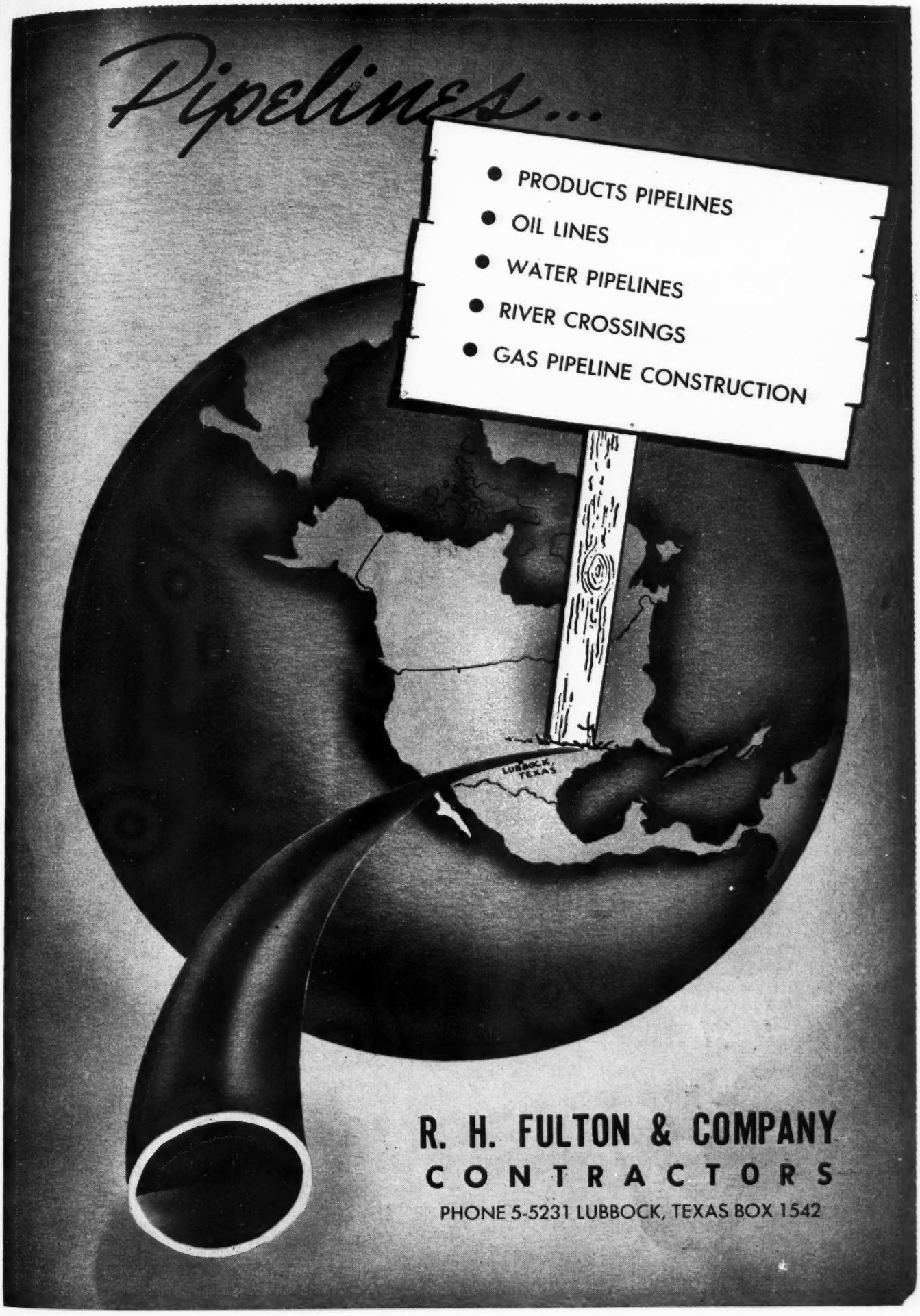
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and designated as Sutter Community A No. 1, gas blew at the rate of 3.5 MMcf a day in a two-hour and 20 minute test.

The well, located on a lease which is jointly owned by Richfield and Buttes Oilfields Inc., was discovered after seismograph and shallow exploratory work conducted by Richfield in the past year. Further exploration of the large holdings of the two companies will be made before completing the well. Although it is too early to attempt to estimate the significance of the discovery, Richfield officials say, this discovery may result in extensive development in the area.

Pipeline Newsnotes

El Paso Natural Gas Co. is planning construction of a cracking plant for the separation of butane and propane from natural gas. It is estimated that the project will cost over $2 million. Location has not been definitely decided upon but may be Gallup, N. M. However, if a proposed railroad is built from Gallup to Farmington, N. M., El Paso will build at Blanco, 100 miles north, C. C. Cragin, vice president and general manager of the company, said.

The Milwaukee Gas Light Co. recently received approval of the Wisconsin state public service commission to provide more natural gas service for areas north of Milwaukee. The project, estimated to cost $881,600, includes two lines. One, consisting of 14- and 16-in. pipe, will extend from the Milwaukee county line and highway 57 to Cedarburg. The other, a 20-in. line, will extend 7 miles east from Menomonee Falls to a connection with the first at the highway 57-Milwaukee county line point.

FPC last month granted temporary authorization to Tennessee Gas Transmission Co., Houston, to construct a 2640-hp natural gas compressor station in the Carthage field in Panola county, Texas. The new station, estimated to cost $880,000, will contain two 1320-hp units. Gas from the station is bought from the Chicago Corp. and then transported from the Carthage field location to a connection with Tennessee's system in Louisiana by United Gas Pipe Line Co. The company said diminishing wellhead pressures made the compressor necessary.

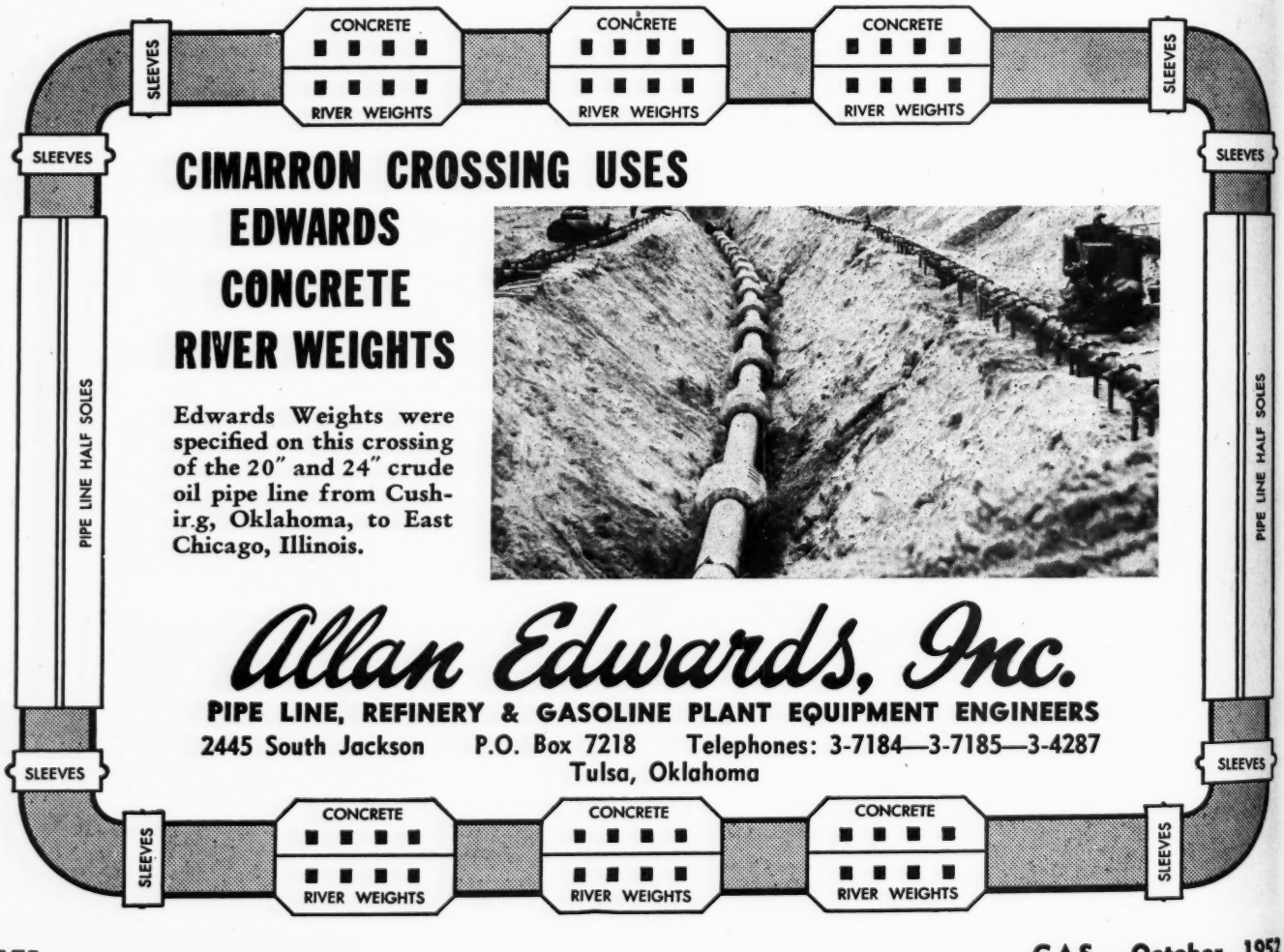
Texas Eastern Transmission Corp., Shreveport, has amended its application to FPC to construct a 315-mile transmission line. The capacity of the proposed line, to extend from a point near Provident City, Texas to Castor, in Louisiana, will be 140 MMcf instead of 200 MMcf daily, and cost of the project is estimated at $23 million instead of $25 million.

A recent order by FPC has denied an application by the public utilities commission of Connecticut for rehearing and reconsideration of the commission's June order revoking authority for Transcontinental Gas Pipe Line Corp., Houston, to deliver 64 MMcf of natural gas per day to Northeastern Gas Transmission Co., Springfield, Mass. for resale in New England. The commission said information on which the Connecticut commission based its appeal was a matter of record and was given consideration at the time FPC issued its order in June.

The Amerada Petroleum Co. has announced it will build a natural gas reclaiming plant to remove gasoline and sulfur from the gas produced by its wells in the Williston basin of North Dakota. The exact size and location of the plant, to cost between $10 and $20 million, will not be determined until the company has more information as to the size of the natural gas reserves in the area. Covering some 400,000 acres, Amerada's Williston holdings comprise the Beaver Lodge and Tioga fields in North Dakota. Gas now flowing from producing oil wells is being burned off.

Cities Service Gas Co., Oklahoma City, has applied to FPC for authorization to install 11,440 hp in compressor capacity on its natural gas pipeline system in Kansas. The proposed additions will be three 1600-hp units at the company's Greensburg station in Kiowa county, and six 1100-hp units at a new station to be located in Harvey county. Estimated cost of the project is $2,781,000. The company said the facilities would help meet the increasing peak day firm demands on its system.

Northern Natural Gas Co., Omaha, has filed another application as directed by FPC covering facilities included in its expansion program to serve the midwest and southwest, which the commission authorized in June. The company had erroneously classified certain facilities, FPC found, as gathering facilities which do not require authorization.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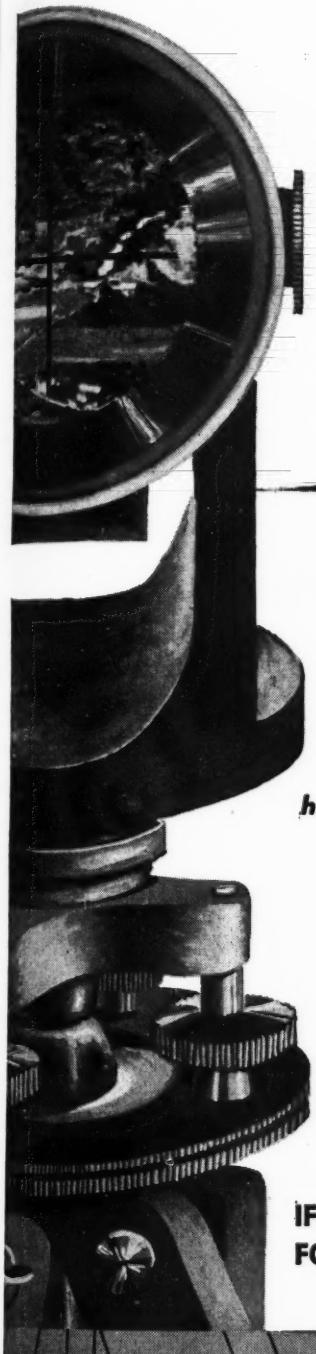

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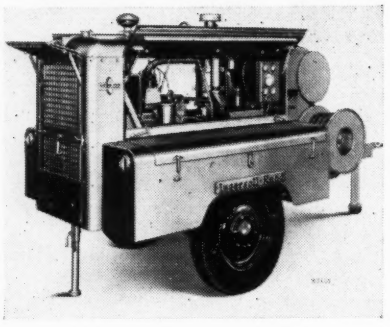
Standard letter sizes of 1½-in. and 3-in. can be cast into all four sides, if required, in accordance with individual requirements. Custom sized letters can be obtained for quantity orders. Markers can be furnished in standard sizes of 4 x 4 in. and 5 x 5 in. and up to 8 ft in length with pre-cast holes for aerial markers, signs, or anchor rods, if desired.

Allan Edwards Inc., 2445 S. Jackson St., Tulsa, Okla.

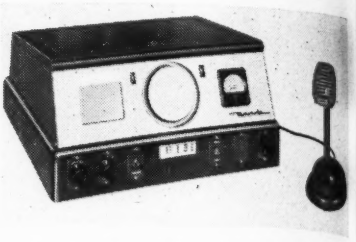


Portable Compressor

Ingersoll-Rand has rounded out its line of Gyro-Flo portable compressors with three sizes in addition to its 600 cfm model. The introduction of 315, 210, and 105 (pictured) cfm units makes the advantages of the rotary sliding-vane design available for a wide range of operating requirements. Major benefits claimed are simplicity and low cost of operation and maintenance, greater reliability, smaller dimensions, reduced weight, and lower discharge temperatures. Many of the problems of reciprocating units for portable service have been eliminated. There are no valves to leak, no pistons, rings, rods, or clutch to wear. Air, discharged at less than 200° under normal operating conditions, together with thorough oil separation, eliminates hose deterioration caused by heat and oil.

The line is equipped with "Air Glide" capacity control, controlling the air output over the full range from 0 to 100% capacity. This combines variable intake unloading of the compressor and "floating speed" control of the engine. Throughout the entire capacity range the air pressure stays between 100 and 110 psi.

Ingersoll-Rand, New York.



Radio Base Station

A locally controlled base station housed in a desk-top cabinet has been introduced by Motorola Inc. as a component of its new line of 450 mc 2-way radio equipment. The new model is designed for use in the 450 to 460 mc range as well as the 460 to 470 mc range. The principal advantage of operation in either of these bands is elimination of the channel crowding encountered on lower frequency bands. Other advantages are less interference, lower noise levels, easier licensing, and extra channels for system expansion. The lower frequency band is restricted to use by organizations involved in land transportation, public safety, and domestic and industrial public services. The higher band is open to individuals and organizations who were previously ineligible.

Motorola Inc., Chicago.

NICOLET ASBESTOS FELT

For Pipe Line Protection

The Miles Laid Per Day
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What You Pay!

ONLY FELT CAN DO THIS

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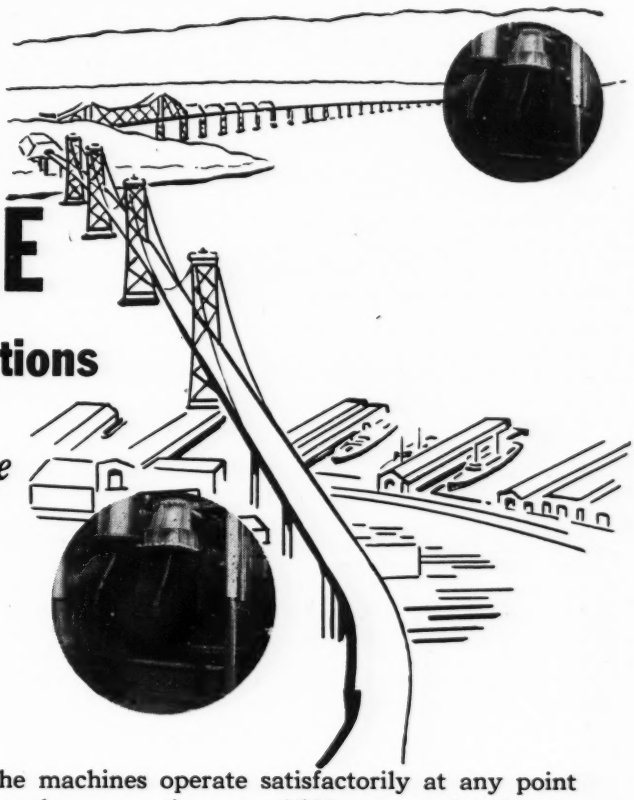
P. O. Box 153 or 2-5216

I-R Blowers assist in delivering

PEAK LOADS for PG&E

at San Francisco and Oakland Stations



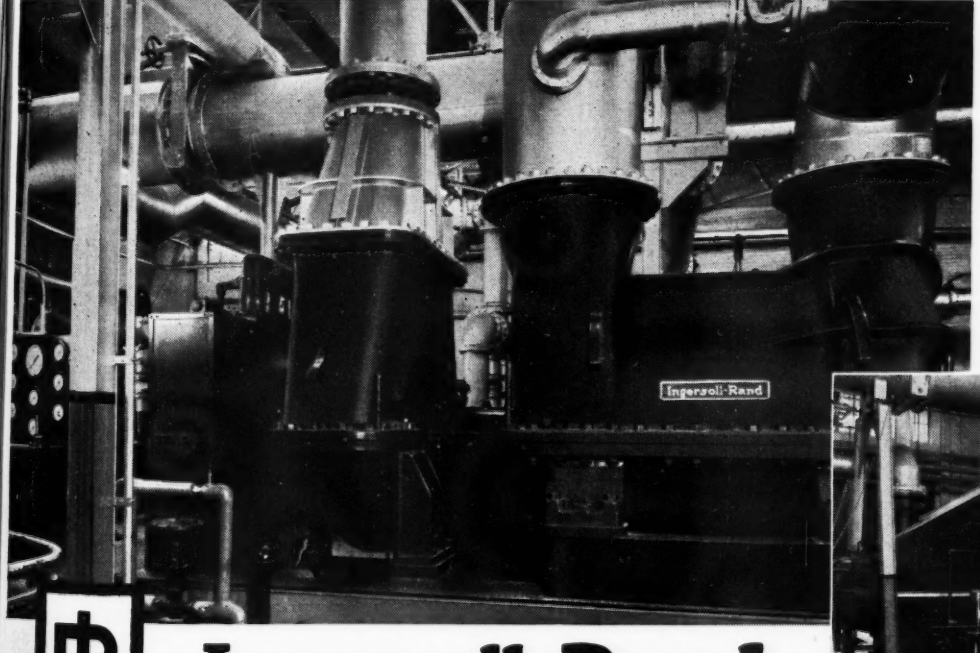
Units are giving excellent wide range performance in Gas Booster Service

To meet increasing peak loads in the Bay Area, two Ingersoll-Rand Turbo-Blowers were installed two years ago by the Pacific Gas & Electric Co.—one at the Potrero Station in San Francisco and the other just across the Bay at Station B in Oakland.

These I-R Blowers (rated at 30,000 and 12,500 cfm respectively) are being used to expand the company's intermediate pressure system. Their installation was primarily an economic measure since they are used as substitutes for additions which would otherwise be required in the high pressure 50 to 60 psig system.

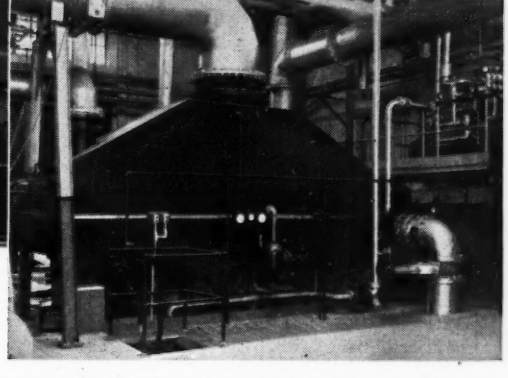
Both Ingersoll-Rand Blowers are giving excellent service and the station operators are particularly pleased with their ease of starting and regulation. Although rated 18 psig at 4500 rpm, the machines operate satisfactorily at any point on the curve down to 1500 rpm and 1.5 psig.

For year round dependability and wide range performance you can depend on Ingersoll-Rand Blowers for Gas Booster service—or any other blower application. Your I-R representative will be glad to help you select the equipment best suited to your particular air and gas handling requirements. His long experience in this specialized field may help you reduce costs all along the line.



I-R gas booster at Potrero Gas Station of Pacific Gas & Electric Co. Four-stage unit is driven by a 2,395 hp turbine at 4,500 rpm.

I-R 3,370 sq. ft. surface condenser at Potrero Station serving the I-R Turbo Blower and other equipment.



Ingersoll-Rand

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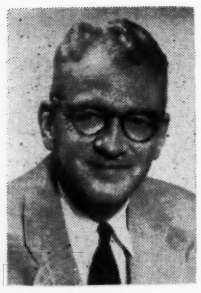
COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO-BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

PIPELINE PEOPLE

JOHN H. CONROY was recently appointed sales manager for Rosson-Richards Co., Houston. He will be in charge of the coating and wrapping and the Wate-Kote divisions of the company. Before joining Rosson-Richards, Mr. Conroy was southern district sales representative for the Barrett division of Allied Chemical & Dye Corp.



J. H. Conroy
Rosson-Richards

J. F. Merriam
Northern Natural

Calgary & Edmonton Corp. Ltd., Winnipeg recently made three new appointments to its board of directors. Elected as members of the board were JOHN MERRIAM, president of Northern Natural Gas Co., Omaha, and G. P. OSLER of Osler, Hammond & Nanton, Winnipeg. E. A. NANTON of the same company was elected president of the board. Mr. Merriam will be the only United States citizen on the board. The Canadian company holds rights to about half of the acreage in the important Pincher creek gas field. It is expected that some of this gas may eventually flow through Northern Natural's lines if proper permits and agreements can be obtained. Negotiations involve a third company, Western Pipe Lines of Canada, of which Osler, Hammond & Nanton, who manage the Calgary & Edmonton Corp., are principal organizers.

W. E. MUELLER has been elected executive vice president of Colorado Interstate Gas Co., Colorado Springs, and Colorado Oil & Gas Corp. He is now senior vice president and director of Tennessee Gas Transmission Co., president and director of Tennessee Gas Building Corp., and director of Tennessee Production Co.

GLENN E. NIELSON of Cody, Wyoming has been elected to the board of directors of Northern Natural Gas Co., Omaha. Mr. Nielson is president of the Husky Oil Co. and Husky Oil & Refining Ltd., Canada. He also serves as chairman of the board for Gate City Steel Works, Omaha.

J. A. Millen

A new management department to be known as the transmission and supply department, has been set up by Southern Counties Gas Co., Los Angeles, with JAMES A. MILLEN, presently division manager of the Texas pipeline division, heading it. As manager of transmission and supply, Mr. Millen will report directly to the vice president and assistant general manager, and will progressively develop a management program covering all transmission and supply operations for the company. Until appropriate organization and staffing can be arranged in the Los Angeles office, Mr. Millen will continue to head the Texas division in Indio, Calif.

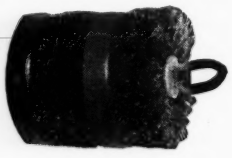
R. E. Hensley

L. P. Head

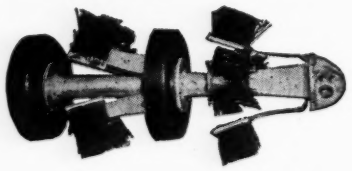
Two new assignments have been announced recently by Cooper-Bessemer Corp. In the Tulsa office ROBERT E. HENSLEY, working directly under branch manager Byron L. Potter, will concentrate his efforts on engineering the installation of diesel engines, gas and air compressors for pipelines, refineries and chemical plants in the Oklahoma area. LAWRENCE P. HEAD has assumed duties as sales engineer in the St. Louis regional office. During 22 years of continuous service with the company Mr. Head has served in Cooper-Bessemer's factories

THE PIG WITH THE POKE — CLEANS PIPE LINES

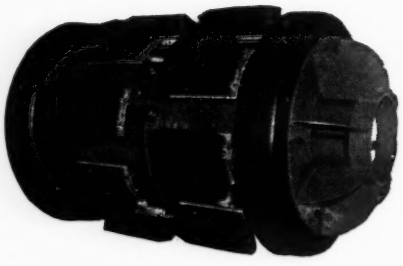
THE VERY LATEST
Williamson Pipe Line Pigs*
FOR CLEANING
NATURAL GAS PIPE LINES



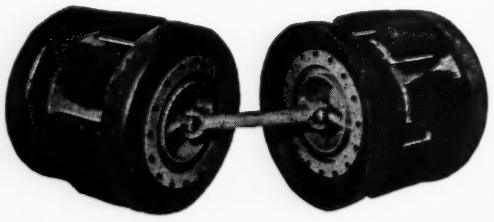
4" Size—TYPE JRN. 2" to 4" sizes. Will pass 1½ R-90° Bends. No valves other than full diameter thru port valves. Use TYPE SCN-51 for 6" size.



8" Size - TYPE WC-11. 8" to 14". Will traverse 6-foot radius field bends, full diameter side openings at 45°. SPRINGS COMPENSATE for BRUSH WEAR.



20" Size - TYPE GP-2. 16" to 30" 200-lb. SPRING forces the brushes against pipe wall — COMPENSATING for WEAR. Will traverse round opening gate or plug valves. SPRINGS and BRUSHES are identical and interchangeable for all types and sizes of GP-PIGS.



24" Size - GP-3. 18" to 30". Sizes will pass 1½ R-30° Bends. SPRINGS COMPENSATE for BRUSH WEAR ASSURING full section cleaning efficiency.

GP-3 consists of two Type GP-1 Pigs —Each Unit may be used as individual pig.

*Patents Pending

T. D. Williamson, Inc.
TULSA 9, OKLAHOMA

STREET SCENE IN NEW HAVEN

Algonquin Gas Company's system of gas pipe line through Connecticut traversed many cities and towns as well as the countryside.
Associated constructed 12 inch line through city of New Haven, home of Yale University.

It pays to associate with

ASSOCIATED
PIPE LINE CONTRACTORS, INC.

Earl Allen, ***President*** **J. W. Sharman,** ***Vice President***

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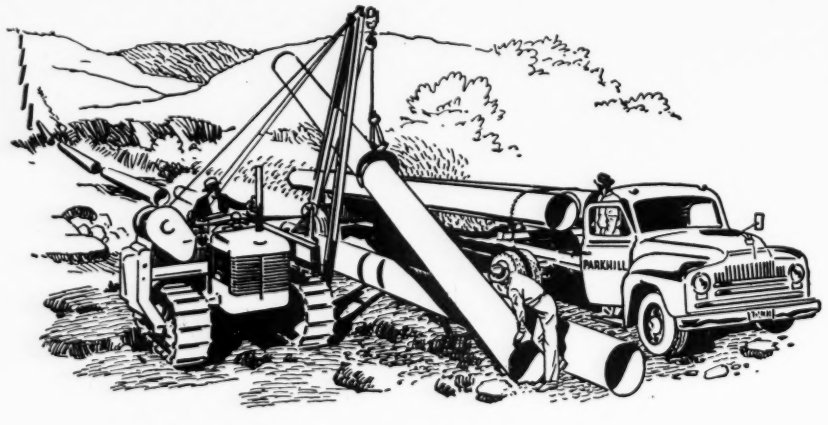
at Mt. Vernon, Ohio and Grove City, Pa., and in the St. Louis territory installing and servicing diesel equipment. His new assignment is part of the company's plan to insure closer contact between its factory engineers and the users of diesel equipment, Vice President Stanley E. Johnson said.

Two newly created positions in the organization of Northern Natural Gas Co., Omaha, have been filled recently. VINCE ROACH has assumed duties of assistant general counsel in the legal department. The position was created to keep pace with expanding work before governmental agencies as well as the increased activities in rate, market and gas supply matters normal to growth and progress of the company. Mr. Roach has been with Northern 12 years. KARL IKARD, a 20-year Northern man, has been appointed to the post of superintendent of gathering in the Hugoton division.

CURTIS BRADFORD has been promoted to superintendent of the transmission department of United Fuel Gas Co., Charleston, W. Va. Mr. Bradford joined the company in 1940 and has been chief inspector of UFG transmission lines constructed by contractors since 1948.

WILBUR A. THORPE, a 15-year veteran of Panhandle Eastern Pipe Line Co., Kansas City, Mo. has been appointed plant superintendent at Olpe compressor station. He has been assistant plant superintendent at Sneed since 1949.

Greetings To The
AMERICAN GAS INDUSTRY



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TULSA, OKLAHOMA

Trap Briscoe
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PROGRESS REPORTS

Planned

ARKANSAS-LOUISIANA GAS CO., Shreveport. Docket G-1979 for 6 miles of 12¾-in. line in Hot Spring county and a 7500-hp compressor station on the company's "Line S" between Waskom, Texas and Perla, Ark.

CAROLINA NATURAL GAS CORP., Charlotte, N. C. Docket G-1956 for 40 miles of line to connect with Transco line near Kings Mountain, N. C., extending to Rock Hill, S. C., with laterals to four South Carolina points.

CENTRAL WEST UTILITY CO., Kansas City. Docket G-1682, four alternate plans to serve Clay county, Mo.

CITIES SERVICE GAS CO., Oklahoma City. Docket G-2038 for installation of 11,440 hp compressor capacity—three 1600 hp units to be added to its Greensburg station, Kiowa county; six 1100 hp units in a new station in Harvey county.

CONNECTICUT GAS CO., Berlin. Docket G-1954 for 5 short pipelines, totaling about 4.7 miles, to extend from Connecticut Light & Power gas plants—2 to Northeastern's system approved; 3 to Algonquin Gas Transmission Co. from plants at Waterbury, Willimantic and Putnam, Conn.

EAST TENNESSEE NATURAL GAS CO., Knoxville. Docket G-1336 for a 100-mile, 16-in. line from near Knoxville to Kingsport, Tenn. with appurtenant equipment.

EL PASO NATURAL GAS CO., El Paso. Docket G-2043 for 96.6 miles main line loop; 7500-hp main line and 5500-hp field compressor stations; field gathering and processing systems for delivery from San Juan basin.

EL PASO NATURAL GAS CO., El Paso. Docket G-2044 for 725.7 miles main line loop; 37,400-hp main line compressor capacity; 181 miles field transmission lines; 124,100 hp in field compressor stations; and various processing plant additions to Permian basin facilities.

FREDERICKSBURG NATURAL GAS CO., Fredericksburg, Va. Docket G-2041 for 28½ miles of 4¼-in. line and .72 mile of 3½-in. line connecting with Transco line, extending to Fredericksburg and area.

GLACIER GAS CO., Butte, Mont. Dockets G-1816, G-1817, G-1818 for 285 miles of 20-in. from northeast of Kalispell, Mont. to Spokane, Wash.; 91 miles of 8⅝-in. from Spokane to Lewiston, Idaho; 120 miles of 16-in. from Spokane to Hanford, Wash.; 130 miles of 12¾-in. from Spokane to south of Trail, B. C.

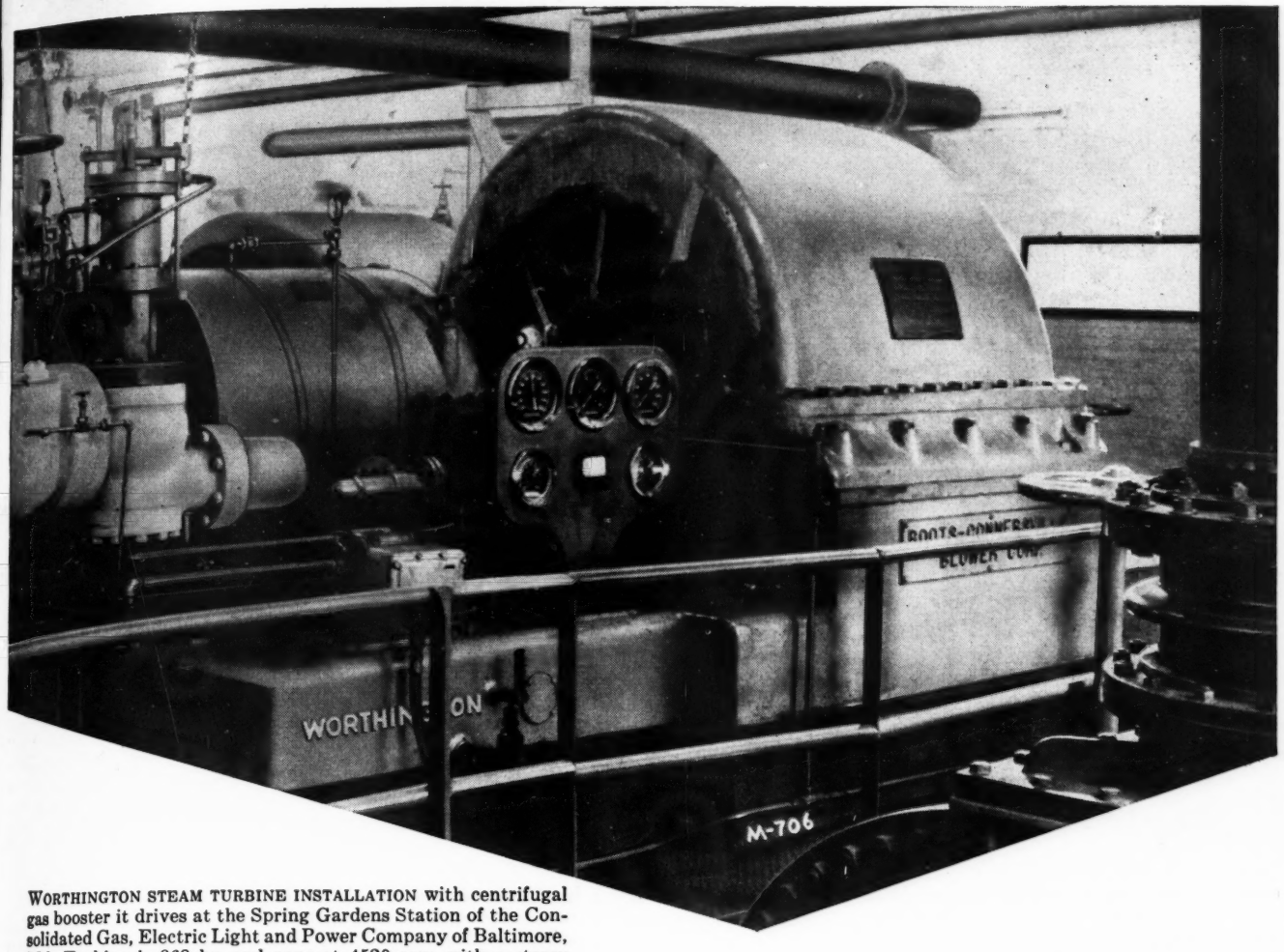
GULF INTERSTATE GAS CO., Houston. To construct 860 miles of 30-in. line from Point Rayne, La. to Boyd county, Ky.

INDIANA GAS & WATER CO. INC., Indianapolis. Dockets G-1813 and G-1937, for 19 miles of 8-in. paralleling Panhandle Eastern Pipe Line's lateral between Panhandle mainline and Crawfordsville; 13 miles of 6-in. paralleling Panhandle lateral from its mainline to Lebanon; both lines to be operated by Panhandle.

KANSAS NEBRASKA NATURAL GAS CO., Hastings. Dockets G-1857 and G-1970. To build 179 miles of line in Kansas and Nebraska and rearrange certain compressors, stub lines and metering stations to serve new mainline industrial customers; and substitution of 49 miles of 10¾-in. line for 52 miles of 8⅝-in.

LONE STAR GAS CO., Dallas. Docket G-2005 for a 2640-hp compressor station and 5 miles of 12-in. line to New York City field reservoir, Clay county, Texas.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh, Pa. Docket G-1893 for 40 miles of pipeline (9.3 miles approved) in Allegheny, Washington, and Beaver counties, Pa., and Belmont, Jefferson, and Columbiana counties, Ohio.



WORTHINGTON STEAM TURBINE INSTALLATION with centrifugal gas booster it drives at the Spring Gardens Station of the Consolidated Gas, Electric Light and Power Company of Baltimore, Md. Turbine is 868 hp and runs at 4520 rpm with a steam pressure of 140 psig 0°F.S.H. Back pressure: 2 psig.

Consolidated Gas, Electric Light and Power Co. of Baltimore drives important gas booster with this Worthington turbine

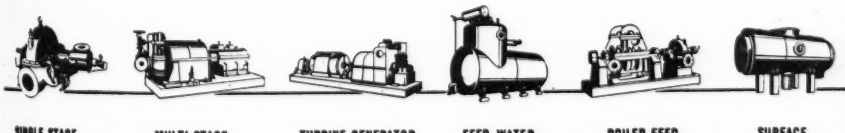
To Consolidated Gas, Electric Light and Power of Baltimore, *reliable performance* of all equipment—especially distribution equipment—is a must.

The Worthington steam turbine illustrated above drives a centrifugal gas booster that delivers gas (either natural or manufactured) from storage holders to the gas mains.

Consolidated has a right to expect day-in, day-out reliability of performance from this turbine. They'll get it because built into it is one important ingredient —*Worthington engineering*. With a broad compressor-drive engineering experience, Worthington can design a steam turbine exactly to fit any mechanical-drive requirement. Hundreds of existing installations of all types and sizes prove this point.

Worthington compressor-drive turbines are available up to 25,000 hp—and a wide variety of governors fits them for all operating conditions. For further information, write to Worthington Corporation, Steam Turbine Division, Wellsville, N. Y.

T.2.11



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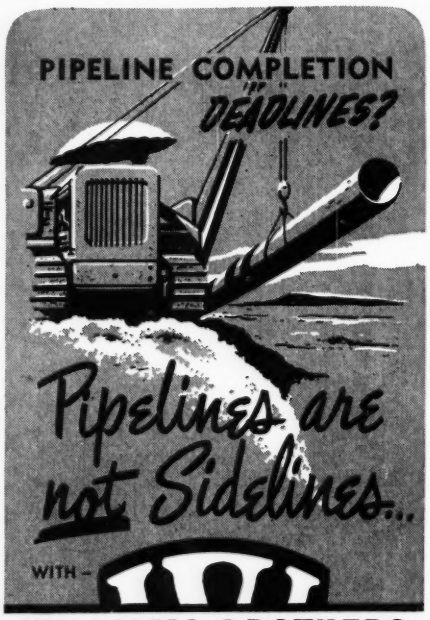
HOUSTON TEXAS



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MIDSOUTH GAS CO., Little Rock, Ark. Dockets G-1445 and G-1680 for 240 miles of line in Greene, Crittenden, St. Francis, Lee, Phillips, Monroe, Woodruff, Poinsett, and Cross counties, Ark.

MISSOURI CENTRAL NATURAL GAS CO., Macon, Mo. Docket G-1509 for 25 miles of 6-in. from Moberly to Macon, Mo.

MORGANFIELD NATURAL GAS CO., Morganfield, Ky. Docket G-1935 for a 31-mile, 4- and 6-in. line lateral to proposed Texas Gas Transmission Corp. line, to serve 6 Kentucky communities.

NEW YORK STATE ELECTRIC & GAS CORP., Ithaca. Docket G-1999 for total of 49 miles of pipeline; 25 miles 10-in. from DeRuyther to Norwich, N. Y., 24 miles 8-in. from Norwich to Oneonta, N. Y.

NEW YORK STATE ELECTRIC & GAS CORP., Ithaca. Docket G-2000 for additional 2200-hp at Auburn compressor station and 9.5 miles 10-in. line paralleling present line from Auburn to Seneca Falls.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh. Docket G-1980 for a 20-mile, 16-in. line from Leidy compressor station, Clinton county to Driftwood gas field, Cameron county; 75-mile, 20-in. line from southern end of Driftwood field line to main dual line in Armstrong county, Pa.; contract for 29 miles of 20-in. line let to Williams-Austin Co., construction scheduled to begin Nov. 1; 970-ft, 20-in. line connecting Sabinsville compressor station to transmission line, Tioga county; 75-mile line to be constructed in 1953; remainder upon approval.

NORTHERN NATURAL GAS CO., Omaha. Docket G-1918 for 400 miles of 24-in. pipe from the United States-Canadian border to a point near Minneapolis and two compressor stations with 5280 hp each.

NORTHERN NATURAL GAS CO., Omaha. Docket G-2009 for a 6.5 mile 30-in. loop line from Bushton, Kan. compressor station, northeasterly to a point in Ellsworth county; a 1.4 mile 8⅝-in. branch line from its Omaha branch line to a proposed regulating station near La Platte in Sarpy county, Nebr.; a 1320-hp addition to Hugoton, Kan. compressor station.

NORTHWEST NATURAL GAS CO., New York. Docket G-996 for 645 miles of 18-, 20-, 22-, and 24-in. line in Washington, Idaho and Oregon, together with laterals and four compressor stations aggregating 24,750 hp.

OHIO FUEL GAS CO., Columbus. Docket G-2013 for 34.5 miles of 20-in. loop in Ohio. Construction tentatively scheduled to begin March 15, 1953.

PACIFIC NORTHWEST PIPELINE CORP., Houston. Docket G-1429 for 1384 miles main line; 316 miles of spur and lateral lines; and 8 compressor stations totaling 61,000 hp, to extend from Ignacio, Colo., in the San Juan basin, to Bellingham, Wash. (Seattle area).

PANHANDLE EASTERN PIPELINE CO., Kansas City, Mo. Docket G-2037 for 6.5 miles of line in Logan county, 13.2 miles in Sangamon county, and a new 330-hp compressor station in Peoria county, Ill.

PERMIAN BASIN PIPELINE CO., Omaha. Docket G-1928 for a 384-mile line from Upton county, Texas, through Lea county, N. M., north to Roosevelt county, N. M., and northeast to Carson county, Texas, connecting with facilities of Northern Natural Gas Co.

PIEDMONT GAS CO. INC., Hickory, N. C. Docket G-1617 for 28 miles 6-in. line.

PUBLIC SERVICE ELECTRIC & GAS CO., Newark, N. J. Docket G-2021 for 11.3 miles of 16-in. line from connection with Texas Eastern to Harrison; 2.96 miles of 10-in. and 2.04 miles of 12-in. from Harrison to Harrison Gas Works and West End Gas Works, Jersey City.

SHENANDOAH GAS CO., Lynchburg, Va. Docket G-1448 for 39 miles of line from a point near Middletown, Va. to points near Winchester, Va. and Martinsburg, W. Va.

"Working with
Motorola 2-Way Radio
is like having
a double crew
on each job!"

Uni-Channel Sensicon Dispatcher puts 2-way contact in every vehicle . . . takes jolts and shocks of rough terrain . . . cuts "dead" mileage . . . speeds operations.

Handie-Talkie® radiophone gives instant contact wherever a man can go . . . reaches mobile units and base stations . . . boosts efficiency of work crews.

Base Station Remote Console controls highpowered transmitter . . . centralizes dispatching . . . co-ordinates drilling, exploration and transport facilities.

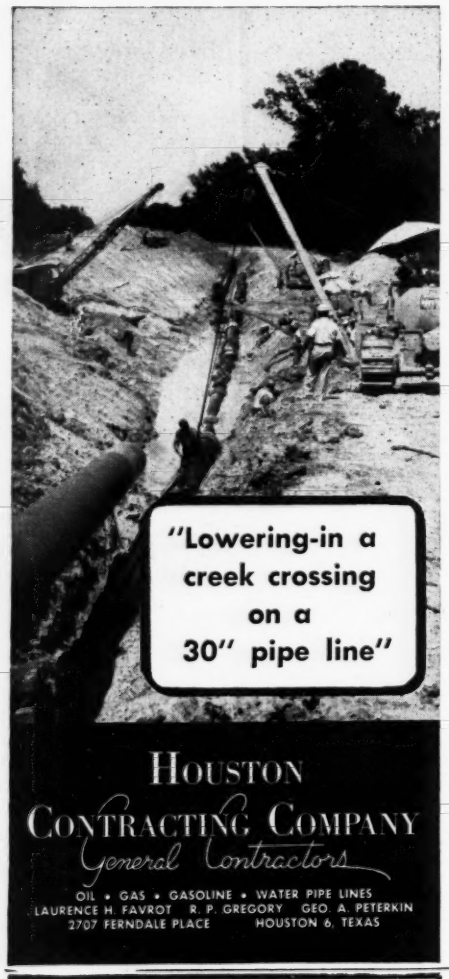
Oilmen are discovering the many labor-saving and safety advantages of MOTOROLA *INSTANT* COMMUNICATION

More and more oilmen are using Motorola mobile radio for vital contact with crews . . . everywhere! Two-way radio brings *instant control* of every situation . . . from routine decision to split-second emergency action. With mobile radio you *co-ordinate* operations . . . cut travel time . . . boost efficiency. Many crews can practically double productive man-hours with on-the-spot communication. Motorola radio is quickly installed, easily operated, ruggedly built—a *hard-working tool* for day-in, day-out utility.

You'll find on your job, too, that Motorola is today's greatest value in 2-way radio. Eight exclusive Motorola features guarantee precision selectivity . . . time-tested durability . . . obsolescence-proof design. With Motorola you get simplified operation, rugged construction, outstanding dependability. Motorola engineering puts 24 years of electronics leadership into every custom-tailored installation. So write today—your friendly local Motorola engineer will gladly show you how Motorola 2-way radio can boost your production.

Motorola®

Communications and Electronics Division
4545 Augusta Blvd., Chicago 51, Illinois
Rogers Majestic Electronics Ltd., Toronto, Canada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SOUTH CAROLINA NATURAL GAS CO., Columbia, S. C. Docket G-1961 for a 160-mile pipeline in Aiken, Lexington, Richland, Orangeburg, Dorchester, Charleston, and Berkeley counties, S. C.

SOUTH GEORGIA NATURAL GAS CO., Birmingham. Docket G-1915 for a 339-mile line to serve communities in southwest Georgia and northern Florida. Main trunk would connect with system of Southern Natural Gas Co. in Lee county, Ala., and extend to Albany, Ga., with a branch to Tallahassee, Fla.

SOUTHERN CALIFORNIA GAS CO. & SOUTHERN COUNTIES GAS CO., Los Angeles. A 13-mile section of 22-in. line with Ventura river crossing to complete line from Goleta field to Los Angeles. To be completed this year.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1907 (partially approved). Application still open for 1102.2 miles of various size pipelines and four compressor stations totaling 13,850 hp in Alabama, Georgia, Mississippi.

TENNESSEE GAS TRANSMISSION CO., Houston. Dockets G-1921 and G-1922 for a presidential permit to construct and operate facilities at the International Boundary north of Niagara Falls and for FPC certificate for 45 miles of 20-in. from Buffalo to Niagara; 107 miles of 26- and 30-in. loop on mainline; six new compressor stations with 80,500 hp; 51,500 hp in old stations; 50 miles of laterals; aerial suspension bridge over Niagara river.

TEXAS EASTERN TRANSMISSION CO., Shreveport. Docket G-1947 for 315 miles of 24-in. line from a point in Lavaca county, Texas to Castor, La., with a 5500-hp compressor station in Shelby county, Texas.

TEXAS-OHIO GAS CO., Houston. Docket G-1810 for 1411 miles of 30-in. from Hildalgo county, Texas, through Arkansas, Mississippi, Tennessee, Kentucky, Ohio, and terminating near Lancaster, Ohio, including 14 compressor stations totaling 135,000 hp.

TRANS-CANADA PIPE LINES LTD., for 2200-mile line from Alberta to major cities as far east as Montreal.

UNITED GAS PIPE LINE CO., Shreveport. Docket G-1951 for 31 miles of 20-in. line from an offshore gas field in the Gulf of Mexico to connect with line under construction in Terrebonne Parish, La.

UTAH NATURAL GAS CO., Salt Lake City. To build a 360-mile line from the San Juan basin to Salt Lake City. A secondary line would run from Last Chance field (Wayne county, Utah) through Sevier and Sanpete counties.

WESTCOAST TRANSMISSION CO. INC., Wilmington, Del., 349 miles, including 277 miles from Sumas, Wash. to Portland, Ore. with short branches to a number of cities in the two states, and 72 miles of laterals and 13 measuring stations. To connect with 683 mile 24-in. line to be built by parent company, Westcoast Transmission Co. Ltd., from Peace river area of Alberta and B.C. Route being surveyed; air photography completed.

WILCOX TREND GATHERING SYSTEM INC., Dallas. Docket G-1959 for 217 miles of line and one 2200-hp compressor station in Lavaca, Jackson, Dewitt, Victoria, Bee, Goliad, Karnes, Live Oak, McMullen, and Duval counties, Texas.

Under Way

ALGONQUIN GAS TRANSMISSION CO., Boston. Facilities to serve designated companies in Massachusetts, Rhode Island, Connecticut, and New Jersey. Includes 253 miles of main line and 279 miles of laterals. Associated Pipeline Contractors Inc. at work on 200 miles in Massachusetts, Connecticut, and Rhode Island; J. F. Fitzgerald Construction Co., Boston, 10 miles near Waltham, Mass.

ARKANSAS-MISSOURI POWER CO., Blytheville. Docket G-1900 for a line from Campbell, Mo. to Blytheville, Ark., and a line from a point just west of the St. Francis river in Clay county, Ark. to Rector, Ark. The total of 140 miles of pipeline is to serve 13 communities in Arkansas and 5 in Missouri. Brown Lite Co., Tulsa, at work on 43 miles of 10-in. line from Campbell, Mo. to Blytheville, Ark.

ATLANTIC SEABOARD CORP., Charleston. Docket G-1850 for two new compressor stations aggregating 7640 hp, with 3080 hp addition to be installed in existing station, all in West Virginia. J. F. Pritchard Co. at work on all three projects.

CHICAGO DISTRICT PIPELINE CO., Joliet, Ill. Docket G-1756 to build 12.4-mile, 30-in. line in Cook county, Ill. Contracting & Material Co. at work near Ontarioville, Ill. Scheduled for completion Dec. 1, 1952.

CONNECTICUT GAS CO., Berlin. Docket G-1954 (in part) 2 lines totaling about 2.7 miles to extend from Northeastern's system to Connecticut Light & Power gas plants at Winsted and Norwalk. Line to Winsted completed; line to Norwalk expected to be completed by October 15.

EL PASO NATURAL GAS CO. Dockets G-1630, G-1631 for about 170 miles of 30-in. mainline loop on existing transmission system, and about 153,000 hp in mainline and booster compressor stations.

FREDERICK GAS CO. INC., Frederick, Md. Docket G-1944 for 26 miles 4½-in. line from Redlands to Frederick, Md.

HOPE NATURAL GAS CO., Clarksburg. Docket G-1946 for 33 miles of various size line to connect with present line in Wyoming county, W. Va., and extend into Buchanan county, Va. Expected to be complete in December.

LONE STAR GAS CO., Dallas. From Garvin county, Okla. to company's Petrolia (Clay county), Texas station, 70 miles of 20-in. Scheduled to be in service by early December. A 30-mile, 12-in. line from Miers gas field, Sutton county, to near Eldorado, awaiting pipe deliveries.

MISSISSIPPI RIVER FUEL CORP., St. Louis. Docket G-1932 for construction of 17 compressor units, totaling 17,345 hp, in 7 existing stations in Arkansas and Missouri, and one new station in Missouri.

MONTANA-DAKOTA UTILITIES CO., Minneapolis. Docket G-1933 for a 2640-hp compressor station in Butte county, S. D. Stearns-Roger Co., Denver, at work. Expected to be completed Nov. 1.

MOUNTAIN FUEL SUPPLY CO., Salt Lake City. Docket G-2003 for a 2640-hp compressor station in Uinta county, Wyo. Contracts have been let and work started.

NATURAL GAS PIPELINE CO. OF AMERICA, Chicago, has Midwestern Constructors at work on station alterations at 107, Emerson, Iowa, and 108, Truro, Iowa; 35% complete.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh. Docket G-1824 for 104.7 miles of line in Pennsylvania and New York and installation of an additional 2420 hp at two existing compressor stations in Westmoreland and Tioga counties, Pa. Williams-Austin Co. is at work on 52 miles of 16-in. line from Utica to Amsterdam, N. Y.

NORTHERN NATURAL GAS CO., Omaha, has Reese Brothers Construction Co. at work on 140 miles of gathering lines in Kansas and Oklahoma, 35 miles completed, remainder to be completed by January 1953.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1993 for a 3300-hp compressor station to be located on company's 14-in. supply line from Logansport (La.) gas field.

TENNESSEE GAS TRANSMISSION CO., Houston. 521 miles of looping along present system; 420 miles, 30-in., Texas, Louisiana, Arkansas, Mississippi, Tennessee, and Kentucky, and 101 miles 26-in., Kentucky and Ohio. Houston Contracting, 45 miles of 30-in., Eros, La. to Coldwater, La. Oklahoma Contracting Co. is building three sections in Texas: 20 miles, Refugio to northeast; 50 miles, East Bernard to Cypress; 47

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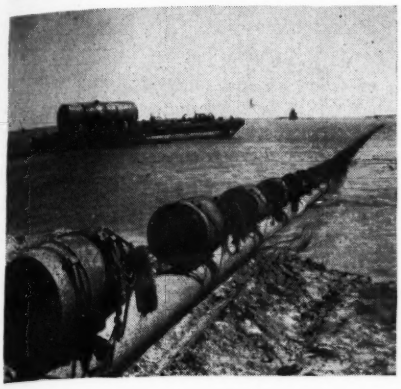

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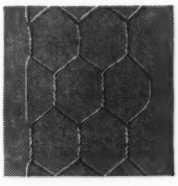

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TEXAS GAS TRANSMISSION CORP., Owensboro. Docket G-1847 for 408 miles of 26-in. loop line in six sections paralleling its line from Bastrop, La. to a point near Louisville, with installation of 28,860 hp in compressor facilities. H. C. Price Co. at work on 125-mile section between Greenville and Lake Cormorant, Miss., 40 miles completed Sept. 1; two spreads scheduled to begin in Tennessee—59 mile section, Sept. 22, 80 mile section Sept. 8. Entire job expected to be completed before winter.

UNITED FUEL GAS CO., Charleston, W. Va. Docket G-1952 for 21.5 miles of gas pipeline, one 880-hp compressor station and addition of 3960 hp to an existing station. Construction of line under way; Fluor Corp. at work on 880-hp compressor station.

UNITED GAS PIPE LINE CO., Shreveport. Docket G-1880 to build 36-mile line from a point near Ingleside, Texas for connection with system near Refugio, Texas.

UNITED GAS PIPE LINE CO., Shreveport. Gulf Southern Contractors at work on 1017 miles of 6- to 30-in. line in Texas, Louisiana, and Mississippi and offshore in the Gulf of Mexico; Brown and Root at work on 9 compressor stations and 10 dehydration plants in the above states. Five suspension crossings, 16 miles 20-in. line near San Antonio, and 24 miles gathering lines complete. Remainder expected to be completed in 1952.

WESTERN SLOPE GAS CO., Denver, 49 miles of main transmission line and 30 miles of gathering lines to bring natural gas to Grand Junction from the Douglas Creek field, Rio Blanco county; Germesa field, Garfield county; and Highline Canal and Asbury Creek fields in Mesa county. Fautz & Bursum, Farmington, N. M. are at work on this project.

Pending Construction

ASSOCIATED NATURAL GAS CO., Tulsa. Docket G-1929 for 32 miles of line for service to Jackson, Portageville, Gideon, Morley, Spoonerville, and Bernie, Mo. Contract let to Boatheel Construction Co., Sikeston, Mo.

COLORADO-WYOMING GAS CO., Denver. Docket G-1821 for 1½-mile 8-in. loop near Cheyenne; 2-mile, 8-in. replacement on Golden, Colo. lateral; and 4-mile, 6-in. line to Rocky Flats Plant of the Atomic Energy Commission. Line to A.E.C. plant will probably be laid in 1952; remainder in 1953, depending on pipe deliveries.

NEVADA NATURAL GAS PIPE LINE CO., Las Vegas. Docket G-1888 for 114 miles of 12¾-in. line from Topock, Ariz. to Las Vegas and Henderson areas. Construction scheduled to start about Feb. 1, 1953. H. G. Laub, pres., 7th & B St., Victorville, Calif.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh, 23-mile, 20-in. line from Tonkin station to Valley Gate, Pa.; 13-mile, 14-in. line from Aurelius to Skaneateles, N. Y.

NORTHERN NATURAL GAS CO., Omaha. Docket G-1618 for 213 miles of 26-in. loop lines in Texas, Oklahoma, Iowa, Kansas, Nebraska and Minnesota, and 100,160-hp additional compressor capacity.

OHIO RIVER PIPELINE CORP., Indianapolis. Docket G-1847 for 13½ miles from point near Louisville, Ky. to a point near Utica, Ind.

OKLAHOMA NATURAL GAS CO., Tulsa. To build 50-mile 18-in. line from Sapulpa to Pryor, Okla. to serve chemical plant to be constructed by Deere & Co. and Grand River Dam Authority furnaces.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-1651 for 86.25 miles 34-in. loop and 19,540 hp addition on existing Topock-Milpitas line.

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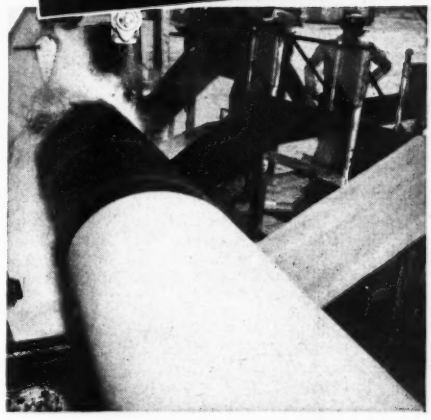

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PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-1892 for 20 miles of 16-in. line from Burrell to a point near Easton and 15 miles of 20-in. pipe extending from Helm and joining the system's Topock-Milpitas line in Fresno county; and for 15.5 miles of 12¾-in. in Madera county parallel to the existing Madera-Livingston line, scheduled for construction in 1953-54.

SOUTHERN CALIFORNIA GAS CO. and **SOUTHERN COUNTIES GAS CO.,** Los Angeles. Docket G-1718 for about 20 miles of 30-in. loop line east from Whitewater, Calif., and 13,520-hp additions to compressor facilities on existing line from California-Arizona boundary to Los Angeles. Construction scheduled to begin in December.

TENNESSEE GAS TRANSMISSION CO., Houston. Dockets G-1573 and G-1614 for 591 miles of line parallel to existing system, a 304-mile line from near Mercer, Pa. to Utica, N. Y. with a total of 165,000 hp to be installed at new and existing compressor stations. Also 250 miles of miscellaneous lines.

UNITED GAS PIPE LINE CO., Shreveport. Docket G-1879 for compressor stations at Napoleonville and Jackson, Miss., for 13,280 total hp; and an addition of 8000 hp at authorized stations near Montpelier, La., and in Walthall county, Miss.

UNITED NATURAL GAS CO., Oil City, Pa. Docket G-1854 for 15.1 miles 12-in line and replacement of 6.5 miles 8-in. line in Venango county, Pa. delayed by pipe deliveries; 12.4 miles 6-in. line and replacement of 2.7 miles of 3-in. line in Warren county, Pa., Case-Pomeroy Oil Corp. at work with Nov. 15 as scheduled completion date. This company also installing Allegheny river crossing.

Approved

HOME GAS CO., Pittsburgh. Docket G-1893 for 13 miles of line in Chemung and Broom counties, N. Y.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh, Pa. Docket G-1893 (in part) for construction of 9.3 miles of line and retirement of 15 miles of line in Allegheny, Washington, Beaver, and Clarion counties, Pa.; retirement of compressor station in Lawrence county, Pa. and compressor unit in Columbiana county, Ohio.

MILWAUKEE GAS LIGHT CO., Milwaukee. Two lines, one 10 miles of 14- and 16-in. pipe extending south from Cedarburg to the Milwaukee county line and connection with the other, a 20-in. line extending east 7 miles from Menomonee Falls.

NATURAL GAS CO., Pittsburgh, Pa. Docket G-1893 for 21 miles of pipeline in Columbiana and Stark counties, Ohio; retirement of two compressor units in Belmont county, Ohio.

NATURAL GAS STORAGE CO. OF ILLINOIS, Chicago. Docket G-1757 to build facilities to develop an underground storage area 15 miles from Kankakee, Ill. First stage approved, to include drilling of 25 wells; construction of 16.7 miles of 30-in. line to storage area; a 10,000-hp compressor station; various small lines, meters and auxiliary facilities.

OHIO FUEL GAS CO., Columbus. Dockets G-1911 and G-1931 for 33 miles of 20-in. to replace 42 miles of existing 8⅝- and 10¾-in. pipe in Crawford, Wyandot, and Seneca counties, Ohio, and 4 miles of 8⅝-in. pipe in Richland county. Contract let to Ohio Pipe Line Construction Co.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1676 for a total of 19,450 hp in three compressor stations in Jefferson Davis and Clarke counties, Miss. and Hale county, Ala.; 60 miles of line—a 20-mile supply line in Ouachita parish, La.; 33 miles triple loop in Ouachita and West Carroll parishes, La.; 7 miles triple loop in Sharkey county, Miss.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1907 (in part) for 87.8 miles of 24-in. and 4.7 miles of 14-in. loop line.

TENNESSEE GAS TRANSMISSION CO., Houston. Docket G-1930 for a 2640-hp compressor station in Carthage field, Panola county, Texas.